SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 18
SEPTEMBER 15, 1969

W69-07264 -- W69-07699

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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se of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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us, Vol 21, No 2, pp 177-184, 1969. 8 p, 1 fig, ef.

criptors: *Mathematical studies, *Energy sfer, *Internal water, *Waves (Water), Turbu-e, Analysis, Density, Advection, Heat flow, es law, Thermodynamics, Stress, Friction, er structure.
tifiers: Internal wave energy transport.

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sbourg Univ. (France). Lab. of Fluid hanics.
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9-07391

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nessee Valley Authority, Knoxville.
er P. Betson, Russell L. Tucker, and Faye M. er.
er Resources Research, Vol 5, No 1, pp 103-, February 1969. 9 p, 5 fig, 2 tab, 5 ref.

criptors: *Mathematical models, *Analytical niques, Optimization, Surface runoff, Compu-, Hydrology.

sing analytical methods, successive restrictions e imposed on a mathematical version of the U. Weather Bureau's graphical surface-runoff del to develop an analytical model that ex-ses the API-runoff relations with two equations five coefficients. The analytical model is lar in concept to the graphical model in that n relate rainfall, week number, and the API sure to surface runoff. The concise relations of analytical model, however, can be rapidly ved from a historical storm list by computer. en tested, runoff relations, derived with the lytical model over selected watersheds, pre-ed surface runoff from those watersheds ewhat better than the regional, graphical rela-s developed for the Valley.
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SOME NOTES ON THE RATIONAL METHOD OF STORM DRAIN DESIGN,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
M. B. McPherson.
ASCE Urban Water Resources Res Prog Tech Mem No 6, Jan 22, 1969. 84 p, 9 fig, 3 tab, 42 ref, 2 append. USGS Contract No. 14-08-0001-11257. Available from Clearinghouse as PB 184 701 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Urbanization, *Storm drains, *Rainfall-runoff relationships, *Rational formula, *Storm runoff, *Design, Drainage systems, Surface runoff, Routing, Hydrographs, Runoff, Hydraulic design, Design flood, Systems analysis, Stream gages, Gaging stations, Coefficient.
Identifiers: Storm drainage design.

Because the 'rational method' of designing urban storm-drainage facilities has substantial liabilities, new design procedures are discussed and the urgent need for more field stream-gaging data is stressed. The limitations of the rational method consist mainly of the weaknesses of projecting standard values of the rainfall-runoff relationship over wide geographical areas, the use of too many standardized assumptions, and using the same runoff routing methods in too many dissimilar situations. Suggested improved design methods would use on-site gaged rainfall-runoff relations to determine flow probabilities in mathematical models so that the optimum drainage system for each particular case may be designed. Presently there are no gaging programs of sufficient scope in operation. Other suggestions include the use of surface detention to flatten runoff peaks, storage of urban runoff for water-supply use, or use of urban runoff as a source of recreational water. (Knapp-USGS)
W69-07482

AVAILABILITY OF RAINFALL-RUNOFF DATA FOR SEWERED DRAINAGE CATCHMENTS,
American Society of Civil Engineers, Cambridge, Mass.
L. S. Tucker.
ASCE Urban Water Resources Res Program Tech Mem No 8, Mar 3, 1969. 43 p, 14 fig, 5 tab, 18 ref, 1 append. USGS Contract No 14-08-0001-11257, OWRR Contract No 14-01-0001-1585. Available from Clearinghouse as PB 184 703 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Data collections, *Gaging stations, *Cities, *Rainfall-runoff relationships, *Urbanization, Drainage systems, Runoff, Storm drains, Sewers, Storm runoff, Flow rates.
Identifiers: Urban runoff gaging, United States.

Data on the availability of rainfall-runoff data from gaged, sewered urban catchments are compiled. Only 13 completely sewered catchments in the U. S. are gaged. Runoff is measured by flume in Northwood, Gray Haven, and Swansea, all in Baltimore, Md. Reduced data from 29 Gray Haven Storms are tabulated. The 13 catchments are summarized in a table giving name, size, data collected, type of flowmeter, type of storm sewer, data available, operator of the installation, location, and period of operation. Each installation and catchment is described in detail. Baltimore has 3 gaged catchments, Cincinnatti, Ohio has 1, St. Louis, Mo. has 3, Chicago, Ill. has 1, Philadelphia, Pa. has 1, New York City has 4, and Washington D. C. has 1. (Knapp-USGS)
W69-07484

RAINGAGE NETWORKS IN THE LARGEST CITIES,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
For primary bibliographic entry see Field 02B.
W69-07485

SEWERED DRAINAGE CATCHMENTS IN MAJOR CITIES,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
L. S. Tucker.
ASCE Urban Water Resources Res Program Tech Mem No 10, Mar 31, 1969. 71 p, 34 fig, 4 tab, 13 ref. USGS Contract No. 14-08-0001-11257. Available from Clearinghouse as PB 184 705 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Cities, *Rainfall-runoff relationships, *Storm drains, *Sewers, Storm runoff, Drainage systems, Water quality control, Water pollution control.
Identifiers: Urban rainfall-runoff-water quality relationships, Combined sewer systems.

The size distribution and number of sewered drainage catchments in San Francisco, Washington, D. C., Milwaukee, Houston, and Philadelphia are summarized to provide data for urban rainfall-runoff-water quality studies. The 4 cities are in 4 distinctly different regions of the US, and are different topographically. The sizes of all sewered drainage catchments are tabulated, maps show catchment boundaries, and supporting discussions are presented. Only the drainage catchments served entirely by storm or combined sewers are discussed, and partially sewered urban drainage catchments are omitted. The distribution of sewered drainage catchment size is unique for each city. The number of catchments varies from 42 in San Francisco to 1,283 in Houston. The largest catchment varies from 1,820 acres in Milwaukee to 6,180 acres in Washington, D. C. The average catchement size varies from 65 acres in Houston to 560 acres in San Francisco. The median catchment size varies from 6 acres in Houston to 190 acres in San Francisco. In Washington, D. C., drainage catchments varying in size from 1 to 50 acres account for 46% of the total number of catchments, but their cumulative area equals only 3% of the total District area served by sewers. On the other hand, over 50% of the total District area served by sewers is accounted for by the 5 largest drainage catchments, which are only 5% of the total of 93 catchments. (Knapp-USGS)
W69-07486

HYDROGRAPHIC CONDITIONS OFF THE NORTHEAST COAST OF ICELAND IN RELATION TO METEOROLOGICAL FACTORS,
Marine Research Institute, Reykjavik (Iceland).
Unnsteinn Stefansson, and Gudmundur Gudmundsson.
Tellus, Vol 21, No 2, pp 245-258, 1969. 14 p, 5 fig, 3 tab, 11 ref.

Descriptors: *Hydrography, *Meteorological data, *Hydrologic properties, Mathematical models, Water circulation, Air temperature, Velocity, Statistical methods, Density, Summer, Winter, Gaging stations, Salinity, Numerical analysis, Pressure, Forecasting, Mapping.
Identifiers: Hydrographic conditions.

The relationship between oceanographical and meteorological parameters of the northeastern coast of Iceland was analyzed analytically and experimentally on the basis of a mathematical model and recorded data given in earlier publications. The study confirms the existence of a strong connection between the oceanographical conditions, air temperature, and N-S winds about 90 days prior to the observations. The study also shows that the air temperature is a more important factor than the winds and its effect on the influx of Atlantic water can be considered to be of indirect character. (Gabriel-USGS)
W69-07503

A NONLINEAR MODEL OF THE FLOW OF AN INHOMOGENEOUS FLUID AT THE EQUATOR (RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
L. M. Krivelevich.
Transl in Vol 4, No 2, pp 188-198. Izv Akad Nauk, Atmos i Okeanicheskaya Fizeka, Vol 4, No 2, pp 105-110, Feb 1968. 6 p, 5 fig, 14 ref.

Descriptors: *Mathematical models, *Mathematical studies, *Equations, *Flow characteristics, Velocity, Density, Water circulation, Thermocline, Water temperature, Water pressure, Diffusion, Momentum transfer.
Identifiers: Nonlinear flow model.

To explain the phenomenon of subsurface equatorial currents a nonlinear model of a current flow was postulated. This analytical model was based on a two-layer model developed by Felsenbaum and Shapiro (1966) and Charney (1960) and assuming the density of each layer to be a known constant value and the density of sea water to be an unknown parameter. By using an electronic computer it was demonstrated that the interaction of oceanic velocity and density fields produces results which agree with the flow patterns recorded at the equator of the oceans. (Gabriel-USGS)
W69-07529

2B. Precipitation

RAINFALL OVER GREAT BRITAIN AND NORTHERN IRELAND DURING 1968,
British Meteorological Office, London (England).
J. Grindley.
Water and Water Eng, Vol 73, No 878, pp 150-154, 161, Apr 1969. 6 p, 1 fig, 4 tab, 4 ref.

Descriptors: *Rainfall, *Meteorological data, *Climates, *Wet seasons, High water mark, Low water mark, Dry seasons, Storms, Precipitation (Atmospheric), Floods, Runoff, Temperature, Snowfall, Snowmelt, Anticyclones, Thunderstorms.
Identifiers: *Great Britain, *Northern Ireland.

Daily, monthly, and annual rainfalls over Great Britain and Northern Ireland were analyzed on the basis of precipitation data recorded at several gaging stations. The study shows that the total rainfall over England and Wales for 1968, although marginally smaller than that for 1967, was again substantially greater than average. The period 1965-68 has been the wettest period of 4 consecutive calendar years since 1927-1930. The year 1968 was dry in both Scotland and Northern Ireland although 1964 was considerably drier. (Gabriel-USGS)
W69-07362

DROUGHT IN AUSTRALIA: A PROBLEM OF PERCEPTION,
Flinders Univ., Bedford Park (Australia). Dept. of Geography.
For primary bibliographic entry see Field 02E.
W69-07371

HYDROLOGICAL FORECASTING IN THE USSR,
Hydrometeorological Service of the USSR (Moscow). Scientific Research Center.
V. V. Rakhmanov, and A. P. Shastin.
Nature and Resources, Vol 5, No 1, pp 9-13, Mar 1969. 5 p.

Descriptors: *Forecasting, *Streamflow forecasting, Flood forecasting, Synoptic analysis, Freezing, Rivers, Snowpacks, Infiltration, Runoff, Evaporation, Evapotranspiration.
Identifiers: USSR.

Hydrological forecasting agencies and techniques in the USSR are briefly reviewed. The most important research center was the Central Forecasting Institute, which in 1966 became the Hydrometeorological Research Center. The water balance method makes it possible to estimate river flow, water losses, and groundwater recharge. Snow sampling data are used in spring flood forecasting. Predictions of river ice formation and breakup are made by techniques of synoptic analysis. State institutes and university departments working in hydrology are listed and their work briefly described. Besides research, the Hydrometeorological Research Center furnishes forecasts, bulletins, warnings of dangerous hydrologic conditions, and notifies water users of particularly favorable conditions. The USSR hydrological network includes over 3000 stations. Annual aerial surveys are made of rivers, ice, and snow cover. (Knapp-USGS)
W69-07379

HYDROLOGIC AND CLIMATOLOGIC DATA, 1968, SALT LAKE COUNTY, UTAH,
Geological Survey, Salt Lake City, Utah.
A. G. Hely, R. W. Mower, and C. A. Horr.
Utah Basic-Data Release No 17, Open-file Rep, 1969. 70 p, 5 fig, 1 plate, 61 tab, 18 ref.

Descriptors: *Data collections, *Climatic data, *Hydrologic data, *Utah, Streamflow, Water quality, Water temperature, Water wells, Water levels, Precipitation (Atmospheric), Winds, Sediment discharge.
Identifiers: Salt Lake County (Utah).

Climatological groundwater and surface-water data for Salt Lake County, Utah, in 1968 are compiled. Tabulated data include precipitation, air temperature, evaporation, wind, well records, water levels, well discharges, water chemical analyses, stream water analyses, water temperatures, sediment discharges, and streamflow records. (Knapp-USGS)
W69-07407

METEOROLOGICAL AND HYDROLOGICAL DROUGHT IN RARITAN RIVER BASIN IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
Chin S. Liu, and W. B. Snow.
OWRR Project A-002-N.J. June 1969. 6 p.

Descriptors: *Droughts, Water balance, *Hydrologic data, Sequential generation, New Jersey, Meteorological data.
Identifiers: *Raritan River Basin, Hydrological data.

The 1961-66 drought in the Northern part of New Jersey was the most intense ever recorded in the region. The meteorological droughts, indicated by the Palmer Drought Index, and the corresponding hydrological droughts were investigated. The drought sequence is a time series characterized by a Markov chain process. Long sequences of generated drought data were utilized for evaluating the various drought distributions.
W69-07457

PHYSICAL STATE PROPERTIES OF PRECIPITATION,
Idaho Univ., Moscow. Dept. of Electrical Engineering.
G. A. McKean, and J. C. Read.
Research Technical Completion Report, March, 1969. 20 p, 4 tab, 5 fig, 9 ref. OWRR Project A-008-IDA.

Descriptors: *Precipitation, *Rain, *Snow, *Precipitation gages, Precipitation (Atmospheric), Rainfall (Impact), Rainfall distribution.

The object of this research was to study the properties of snow or rain in the falling state that would permit positive identification of the state of the precipitation. The ultimate application was to provide a record of when it was raining or snowing and to provide a means of relating the record to conventional recording precipitation gage records. Various properties of precipitation were evaluated both by literature search and by laboratory investigation. Properties investigated included conductivity, storage of static charge, impact momentum, acoustic energies, and both optical reflectivity and opacity. Optical reflectance proved to have the most promise and a scheme for making such a measurement was proposed. Subsequent to this a prototype device was developed.
W69-07458

SURFACE-RUNOFF MODEL DEVELOPED BY ANALYTICAL METHODS,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 02A.
W69-07464

RAINGAGE NETWORKS IN THE LARGEST CI TIES,
American Society of Civil Engineers, Cambridge Mass. Engineering Sciences Lab.
L. S. Tucker.
ASCE Urban Water Resources Res Program Tec Mem No 9, Mar 17, 1969. 90 p, 24 fig, 24 tab USGS Contract No 14-08-0001-11257; OWR Contract No 14-01-0001-1585. Available fro Clearinghouse as PB 184 704 at $3.00 in pape copy and $0.65 in microfiche.

Descriptors: *Cities, *Rain gages, *Networks, *In strumentation, Rainfall-runoff relationships, Stor runoff, Storm drains, City planning, Utilities, Wat resources development.
Identifiers: Urban rain gage networks.

The extent of raingage networks in the 20 large cities in the U. S. is described and the history available data is given. The number of raingages and around these cities varies from 1 to 162. Th cities of Boston, New York, Phoenix, Pittsburg and San Francisco are served only by first ord USWB recording raingage stations. Recording r ingages in addition to the USWB stations a operated and maintained in and around 15 of th 20 largest cities. These cities are Baltimor Chicago, Cleveland, Dallas, Detroit, Houston, L Angeles, Milwaukee, New Orleans, Philadelphi St. Louis, San Antonia, San Diego, Seattle, a Washington, D. C. Information on the numbe type, location, and history of the gages, and on th form, use and availability of rainfall data for the 15 cities is presented. The metropolitan area wi the largest network of recording raingages is L Angeles where 162 raingages are operated. Th distance between most extreme raingages is in e cess of 70 miles. Seattle has a unique method f recording, reducing and processing rainfall da which was put in operation in early 1965. Rainf data are recorded on tapes, translated to comput cards and processed through a computer with minimum of manual data handling. Chicago has th greatest amount of reduced historical data. The are 79 storms dating from 1932 to 1963 for whi rainfall is reduced to 5-minute intervals for a ne work varying between 12 and 19 gages. A summa of the raingage network information for 15 of th 20 largest cities is tabulated. (Knapp-USGS)
W69-07485

A TECHNIQUE TO INFER ATMOSPHERI WATER-VAPOR MIXING RATIO FROM ME SURED HORIZON RADIANCE PROFILES,
National Aeronautics and Space Administratio Langley Station, Va. Langley Research Center.
For primary bibliographic entry see Field 07B.
W69-07491

HYDROGRAPHIC CONDITIONS OFF TH NORTHEAST COAST OF ICELAND IN REL TION TO METEOROLOGICAL FACTORS,
Marine Research Institute, Reykjavik (Iceland).
For primary bibliographic entry see Field 02A.
W69-07503

AUTOMATIC CALCULATION OF MEA MONTHLY AND ANNUAL PRECIPITATION WHICH SOME MEASUREMENTS AR MISSING (FRENCH),
Office de la Recherche Scientifique et Techniq Outre-Mer, Paris (France). Dept. of Hydrologi Research.
For primary bibliographic entry see Field 07C.
W69-07538

OPTIMIZATION TECHNIQUES IN WEATH MODIFICATION,
Denver Research Inst., Colo.

J. Stinson.
oc, Nat Symp Anal Water-Resource Syst, pp 79-, Denver, July 1968. 16 p, 8 fig, 11 ref.

escriptors: *Weather modification, *Optimiza-n, *Systems analysis, *Clouds, Cloud seeding, mputer programs, Simulation analysis, Mathe-atical models, Precipitation (Atmospheric), atistical methods, Dynamic programming, Deci-n making.
entifiers: Precipitation management.

ptimum methods that can be used in the sequence analyses and techniques called precipitation anagement or weather modification were scussed. The weather modification system was agrammed and described, beginning with the oud system and cloud seeding technology, and en continuing with analytical techniques such as atistical tests and computer simulation. Several nulation modeling approaches were outlined, d the use of dynamic programming for multistage cision models for the total system was discussed. was concluded that maximum effectiveness could st be achieved through the optimization of a quence of the above processes and their interac-ns, using a scientific, interdisciplinary approach hich included systems engineering, systems analy-, and other operations research techniques. For ain entry see W69-07562. (Gysi-Cornell)
69-07566

C. Snow, Ice, and Frost

YDROLOGICAL FORECASTING IN THE SSR,
ydrometeorological Service of the USSR Moscow). Scientific Research Center.
or primary bibliographic entry see Field 02B.
69-07379

ESULTS OF THEORETICAL AND EXPERI-IENTAL STUDIES OF FRAZIL ICE TRANS-ORT BY SUSPENSION IN A STREAM (RUS-IAN),
ll-Union Scientific Research Inst. of ydrotechnics and Reclamation (USSR).
G. Zagirov.
okl Akad Nauk Tadzh SSR, Vol 11, No 7, pp 16-0, 1968. 5 p, 2 fig, 7 ref.

escriptors: *Frazil ice, *Transportation, Suspended load, *Streamflow, *Mathematical udies, Winter, Velocity, Hydrologic data, Tem-erature, Critical flow, Freezing, Roughness coeffi-ent, Hydraulic properties.
lentifiers: Frazil ice stream transport.

razil ice transport by streams was investigated nalytically and experimentally. The analytical nalysis was made on the basis of the theory of nergy transport developed by G. T. Dmitriyev 1952) and experimental formulas on the weight of azil ice in a stream current developed by V. M. otapov (1955), professor A. S. Obrazovskiy 1962), and the author (1968). The experimental udies show that the stream velocities which uarantee a complete distribution of frazil ice in a ream current are correctly given by using the uthor's formula. (Gabriel-USGS)
69-07416

RGANIC MATTER IN THE GLACIOMARINE EDIMENTS OF THE EASTERN ANTARCTIC,
kademiya Nauk SSSR. Institut Geologii i azrabotki Goryuchikh Iskopaemykh.
or primary bibliographic entry see Field 02J.
69-07528

D. Evaporation and Transpiration

OIL MOISTURE DEPLETION AND ESTI-IATED EVAPOTRANSPIRATION ON UTAH VATERSHEDS,
ntermountain Forest and Range Experiment Sta-on, Ogden, Utah.
Norbert V. DeByle, Robert S. Johnston, Ronald K. Tew, and Robert D. Doty.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 14 p, 3 fig, 3 tab.

Descriptors: *Watershed management, *Evapotranspiration, *Soil-water-plant relationships, *Vegetation effects, Watersheds (Basins), Arid lands, Water yield improvement, Hydrologic cycle, Soil moisture, Water balance, Habitat improvement, Ground cover effects, Utah.

Evapotranspiration is the principle component of the hydrologic cycle that can be modified by watershed managers. In the western U.S. measured soil moisture depletion plus summer precipitation gives a good estimate of actual evapotranspiration. 14 sites representing 10 vegetative types typical of Utah's water yielding lands were studied. Soil moisture depletion during the growing season, measured with the neutron scatter technique, varied from 0.88 in. under a young stand of aspen sprouts to 20.38 in. under a mature aspen stand. Losses from grass, Gamble oak, sagebrush, snow berry, Douglas fir and bare soil were intermediate. The resulting inventory of water use by native plant communities, elevation 6,100 ft. to 9,200 ft., provides a basis for further water yield improvement research, especially for measuring effects of converting or modifying vegetation on watersheds in arid regions. (Sherbrooke-Ariz)
W69-07347

THE INFLUENCE OF EVAPORATION ON THE QUALITY OF WATER STORED IN SAND,
National Inst. for Water Research, Windhoek (South Africa).
D. H. R. Hellwig.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 30 p, 8 tab, 7 fig, 6 ref.

Descriptors: *Evaporation, *Underground storage, *Arid lands, Soil water movement, Water loss, Natural recharge, Subsurface waters, Aeolian soils, Water table, Hydrologic properties, Leaching, Salt balance, Soil water, Dissolved solids.
Identifiers: South West Africa.

A determination was made of the effect of evaporation on the salt concentration of water at various depths, when stored in sand. Three different sand mixtures in 10 evaporation tanks with three different water tables were used. Rate of evaporation and loss of salts from solution increased with firmness of sand and decreasing depths of water table from the surface. Salt loss from solution (%) increased with evaporation according to a hyperbolic relationship; salt accumulated at or above the water table. Water quality near the bottom was unchanged by high evaporation. Heavy rain washed salts from sand above the water table downward, increasing the T.D.S. concentration. This effect increased with coarseness of sand and depth of water table. These results assist in a better understanding of the influence of evaporation on the salt concentration of water stored in sand beds of rivers in arid regions. (Sherbrooke-Ariz)
W69-07349

THE EFFECT OF INORGANIC SEDIMENT ON STREAM BIOTA,
DePauw Univ., Greencastle, Ind.
For primary bibliographic entry see Field 05C.
W69-07455

HEAT FLUX AND TEMPERATURE VARIATION AT A WAVY WATER-AIR INTERFACE,
State Univ. of New York, Stony Brook. Coll. of Engineering.
Edward E. O'Brien, and Thore Omholt.
J Geophys Res, Vol 74, No 13, pp 3384-3385, June 20, 1969. 2 p, 6 ref. NSF Grant No GK1715.

Descriptors: *Air-water interfaces, *Waves (Water), *Heat flow, *Heat transfer, Convection, Conduction, Evaporation, Boundary processes, Heat balance, Temperature, Thermal stratification, Solar radiation.
Identifiers: Heat flux.

Surface temperature and heat flux variations induced by a progressive wave on a thin layer of water across which steep thermal gradients exist may be predicted. It is shown that molecular conduction and convection due to the wave alone, excluding any buoyancy induced convection, do not account for the behavior of the surface temperature that has been observed in a wave tank. (Knapp-USGS)
W69-07487

EVAPORATION FROM AN EXTREMELY NARROW WET STRIP AT GROUND LEVEL,
Cornell Univ., Ithaca, N. Y.
Wilfried Brutsaert, and Gour-Tsyh Yeh.
J Geophys Res, Vol 74, No 13, pp 3431-3433, June 20, 1969. 3 p, 1 fig, 4 ref. NSF Grant No GK-312.

Descriptors: *Evaporation, *Air-earth interfaces, *Soil water, Boundary processes, Mathematical models, Water loss, Heat budget, Mass transfer, Solar radiation, Microenvironment, Soil water movement, Winds, Convection, Turbulence, Diffusion, Dispersion.
Identifiers: Wet ground evaporation.

A solution is obtained for the turbulent diffusion equation, considering only the upward and forward diffusion but neglecting the lateral diffusion and the forward convection by the mean wind. With the proper boundary conditions this equation describes evaporation from an extremely narrow wet surface at ground level, which extends laterally to infinity. Comparison of this solution with an earlier solution for evaporation from an extremely small circular surface shows that the effect of lateral diffusion on the evaporation from such a surface increases with increasing stability of the atmosphere. This effect is under neutral conditions probably of the order of 13%. (Knapp-USGS)
W69-07488

STUDY OF ENERGY BALANCE AT BRAZZAVILLE (FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France). Dept. of Hydrological Research.
Ch. Riou, and R. Chartier.
Cah ORSTOM, Ser Hydrol, Vol 5, No 4, pp 25-42, 1968. 18 p, 4 fig, 4 photo, 1 tab, 3 ref.

Descriptors: *Energy budget, *Energy equation, *Evapotranspiration, Lysimeters, Temperature, Latent heat, Sun, Radiation, Albedo, Air circulation, Heat balance, Atmospheric physics, Humidity, Soil temperature, Seasonal, Heat flow, Vegetation, Forests, Vapor pressure, Tension, Turbulence.
Identifiers: Brazzaville energy-balance study.

This investigation was the study of the application of the energy-balance method to the data given by Bowan in his report on a turbulent flow observed at Brazzaville and R. Charteer's albedo measurements conducted in the Brazzavile area. The computed parameters of the energy balance method were the total radiation, reflected radiation, temperature and humidity gradients above the ground, temperature gradient of the ground, evapotranspiration, and other pertinent coefficients. The study shows that it is perhaps premature to draw some definite conclusions from the results of this study, although the goal of this study was the presentation of a technique suitable for a humid climate. However, it is strongly believed that an improved energy-balance method offers the best possibility for the determination of the reaction of vegetable cover to the solar energy radiation. (Gabriel-USGS)
W69-07537

2E. Streamflow and Runoff

STREAM BOUNDARIES OF SUBCRITICAL FLOW IN A TRAPEZOIDAL CHANNEL EXPANSION,
London Univ. (England); and West Ham College of Tech., London (England).
S. K. A. Naib.
Water and Water Eng, Vol 73, No 878, pp 155-158, Apr 1969. 4 p, 8 fig, 11 ref.

Descriptors: *Subcritical flow, *Streamflow, *Streamflow forecasting, *Model studies, Mathematical studies, Flow measurement, Jets, Velocity, River beds, Slopes, Energy dissipation, Pressure, Water Circulation.
Identifiers: Critical flow model study.

Stream boundaries of subcritical flows were investigated by both analytically and experimentally by using rectangular and trapezoidal channel models and a theoretical solution for the flow behind a two-dimensional bluff body developed by G. K. Abramovich. Measurements of the velocity profiles and flow boundaries in the mixing region of a rectangular stream expanding abruptly into a trapezoidal channel with side slopes of 1 vertical to 2 horizontal were made and presented here as the generalized curves of velocity profiles, spreading of stream boundaries, variation of left and drag coefficients, and other parameters. A rational method for designing the protection downstream of sudden transitions is suggested. (Gabriel-USGS)
W69-07366

METEOROLOGICAL CAUSES FOR THE AUGUST FLOODS BETWEEN 1950 AND 1960 (FRENCH),
Rene Viala.
Rev Geogr Des Pyrenees Et Sud-Ouest, Vol 40, No 2, pp 171-178, Apr 1969. 8 p, 5 fig, 3 tab.

Descriptors: *Floods, *Meteorological data, Water balance, Rain, Precipitation (Atmospheric), Climates, Discharge (Water), Gaging stations, High water mark, Low water mark, Winter, Summer, Spring, Storm runoff, River basins, Winds.
Identifiers: Meteorological causes of floods.

Meteorological effects on August floods were investigated on the basis of hydrological and meteorological data recorded in France during the 1950-1960 period. The study shows that the topography of a region, the line separating the Atlantic waters from those of the Mediterranean Sea, and rain intensity play a significant role in developing floods in France. (Gabriel-USGS)
W69-07367

TIDAL WAVE CALCULATIONS FOR VARIOUS RIVER REGULATION STAGES DEMONSTRATED BY EXAMPLE OF THE LOWER WESER AND THE LOWER HUNTE RIVERS (German),
For primary bibliographic entry see Field 02L.
W69-07368

FLOOD PLAIN INFORMATION OF SOUTH FORK PALOUSE RIVER AND MISSOURI FLAT CREEK, PULLMAN, WASHINGTON.
Corps of Engineers, Walla Walla, Wash.
For primary bibliographic entry see Field 04A.
W69-07370

DROUGHT IN AUSTRALIA: A PROBLEM OF PERCEPTION,
Flinders Univ., Bedford Park (Australia). Dept. of Geography.
R. L. Heathcote.
Geogr Rev, Vol 59, No 2, pp 175-194, Apr 1969. 20 p, 4 fig, 60 ref.

Descriptors: *Droughts, *Rainfall, *Climates, *Meteorological data, Water uses, Plants, Animal populations, Plant growth, Moisture availability, Water shortage, Economics, Water costs, Water resources development, Soils, Ecology, Arid lands, Water policy.
Identifiers: *Australia, South Australian drought.

This article defines the drought phenomenon in general and investigates its occurrence in Australia in the periods 1888-1900 and 1958-1965. The investigation contains the following chapters: (1) the identification of drought (definition, measurement, registration); (2) the recognition of drought effects (negative effects, positive effects); (3) the appraisal of drought (attitudes and reactions); and (4) planning for the future. (Gabriel-USGS)
W69-07371

A SEMIAUTOMATIC METHOD FOR REDUCING STREAMFLOW RECORDS,
Utah State Univ., Logan. Dept. of Forest Science.
For primary bibliographic entry see Field 07C.
W69-07376

FLOOD PLAIN INFORMATION, CEDAR RIVER, RENTON, WASHINGTON.
Corps of Engineers, Seattle, Wash.
For primary bibliographic entry see Field 04A.
W69-07384

SPATIAL ORDER IN FLUVIAL SYSTEMS: HORTON'S LAWS DERIVED FROM MIXED HEXAGONAL HIERARCHIES OF DRAINAGE BASIN AREAS,
Harvard Univ., Cambridge, Mass. Computer Graphics and Spatial Analysis Lab.
For primary bibliographic entry see Field 04A.
W69-07394

THE WILLAMETTE RIVER, FLOOD CONTROL OR FLOOD MANAGEMENT,
Oregon State Univ., Corvallis. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 04A.
W69-07395

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS, IN NEBRASKA.
Corps of Engineers, Omaha, Nebr. Missouri River Div.
For primary bibliographic entry see Field 04A.
W69-07397

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NORTH DAKOTA.
Corps of Engineers, Omaha, Nebr. Missouri River Div.
For primary bibliographic entry see Field 04A.
W69-07398

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN OHIO.
Corps of Engineers, Huntington, W. Va. Ohio River Div.
For primary bibliographic entry see Field 04A.
W69-07399

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN OKLAHOMA.
Corps of Engineers, Dallas, Tex. Southwestern Div.
For primary bibliographic entry see Field 04A.
W69-07400

WATER RESOURCES DEVELOPMENT I THE U.S. ARMY CORPS OF ENGINEERS OREGON.
Corps of Engineers, Portland, Oreg. North Paci Div.
For primary bibliographic entry see Field 04A.
W69-07401

WATER RESOURCES DEVELOPMENT I THE U.S. ARMY CORPS OF ENGINEERS PUERTO RICO AND THE VIRGIN ISLANDS.
Corps of Engineers, Atlanta, Ga. South Atlan Div.
For primary bibliographic entry see Field 04A.
W69-07402

THE EFFECT OF THE BEGINNING OF HYDROLOGICAL YEAR ON THE STATIST CAL PARAMETERS OF STREAMFLOW A REQUIRED RESERVOIR CAPACITY (RU SIAN),
Nauchno-Issledovatelskii Gidroenergeticheskii stitut, Tiflis (USSR).
G. G. Svanidze, and A. N. Kilasoniya.
Meteorol Gidrol, No 1, pp 66-73, 1969. 8 p, 4 fig tab, 9 ref.

Descriptors: *Parametric hydrology, *Streamflo *Streamflow forecasting, *Statistical metho *Mathematical studies, Runoff, Dischar (Water), Hydrograph analysis, Reservoir storag Seasonal, River basins, Low water mark, Corre tion analysis.
Identifiers: *USSR, Reservoir capacity, Statisti parameters.

The effects of the beginning of a hydrological y were investigated analytically and experimenta using statistical methods and hydrograph d recorded at the hydrological stations along the A gara, Neva, Volga, and other rivers of the USS The study shows that the mean annual wa discharge can be considered as practically statio ry and can be considered as being of a consta value for different hydrograph divisions. The stu shows that though the annual runoff values basically constant the transfer of single monthly noffs from one group to another introduces c siderable changes in the maximum values of ann runoff. (Gabriel-USGS)
W69-07403

FLOODS IN RICHMOND QUADRANGL NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 04A.
W69-07405

WATER RESOURCES OF THE MILLE RIVER BASIN, NORTH-CENTRAL MA SACHUSETTS AND SOUTHWESTERN NE HAMPSHIRE,
Geological Survey, Washington, D. C.
M. R. Collings, D. R. Wiesnet, and W. B. Fleck.
Geol Surv Hydrol Invest Atlas HA-293, 4 she 1969. 44 fig, 2 map, 9 tab, 37 ref.

Descriptors: *Water resources, *Surface wate *Groundwater, *Massachusetts, *New Hampshi Water wells, Water quality, Streamflow, Runo Aquifers, Reservoirs, Stream gages, Hydrolo budget.
Identifiers: Millers River (Mass-N. H.).

The water resources of the Millers River Bas Massachusetts and New Hampshire are su marized in a 4 sheet hydrologic atlas consisting maps, graphs, charts, and text. Streamflow, floo precipitation, reservoir storage, diversio aquifers, pumpage, well yields, transmissiviti water quality, water utilization, and pollution discussed and data are presented graphically. napp-USGS)
W69-07406

VAILABILITY OF RAINFALL-RUNOFF DATA OR SEWERED DRAINAGE CATCHMENTS,
merican Society of Civil Engineers, Cambridge, ass.
or primary bibliographic entry see Field 02A.
69-07484

NEW METHOD OF INVESTIGATING RIVER ECESSION CURVES,
sk River Authority, Newport (England).
or primary bibliographic entry see Field 07B.
69-07493

ECONNAISSANCE OF THE RED LAKE IVER, MINNESOTA,
eological Survey, Washington, D. C.
or primary bibliographic entry see Field 04A.
69-07505

ATER RESOURCES OF THE BIG OTTER REEK DRAINAGE BASIN,
ater Resources Commission (Ontario).
or primary bibliographic entry see Field 03B.
69-07508

LOOD PLAIN INFORMATION OF GRAND IVER, INGHAM COUNTY AND EATON OUNTY, MICHIGAN.
orps of Engineers, Detroit, Mich.
or primary bibliographic entry see Field 04A.
69-07509

LOOD PLAIN INFORMATION OF BLACK IVER, SPRINGIELD, VERMONT.
orps of Engineers, Waltham, Mass. New England v.
or primary bibliographic entry see Field 04A.
69-07510

ATER RESOURCES OF WINDWARD OAHU, AWAII,
eological Survey, Washington, D. C.
J. Takasaki, G. T. Hirashima, and E. R. Lubke.
eol Surv Water-Supply Pap 1894, 1969. 119 p, 56 , 3 plate, 22 tab, 37 ref.

escriptors: *Water resources, *Groundwater, Iawaii, Aquifers, Permeability, Streamflow, ater storage, Discharge (Water), Water wells, ater quality, Data collections, Hydrologic data, ater-level fluctuations, Water levels.
entifiers: Oahu (Hawaii).

kes, mostly vertical and parallel or subparallel to e fissure zone, control movement and discharge groundwater because they are less permeable an the rocks they intrude. Dikes impound or rtly impound ground water by preventing or re-rding its movement toward discharge points. rmeability is high in less weathered mountain eas and is highest farthest away from the dike mplex. Ground-water storage fluctuates to some gree owing to limited changes in the level of the ounwater reservoir-maximum storage is about ,000 million gallons. Perennial streams intersect gh-level water and collectively form its principal scharge. The larger streams are those that cut epest into high-level reservoirs. Except near the ast in the northern end of the area, where dikes e absent, total base flow of streams equals total oundwater discharge. The dependable flow of ter is estimated at 118 mgd, of which 84 mgd is scharged by streams, tunnels, springs, and wells. e remaining 34 mgd is underflow, most of it scharging into the sea near the northern end of e area. Average flow is estimated at 220 mgd, of hich 150 mgd is inventoried flow and 61 mgd is timated underflow. Specific capacity of wells pping lava flows of the Koolau Volcanic Series nges from less than 1 to 11 gpd/ft of drawdown in e dike-complex zone and from 2 to 100 in the rginal dike zone. A transmissivity of 4,000,000 d/ft was determined for the basal aquifer. The emical quality of water in wells and tunnels tapping rocks of the Koolau and Honolulu Volcanic Series is excellent. (Knapp-USGS)
W69-07516

BIBLIOGRAPHY OF HYDROLOGY OF THE UNITED STATES AND CANADA,
Geological Survey, Washington, D. C.
J. R. Randolph, N. M. Baker, and R. G. Deike.
Geol Surv Water-Supply Pap 1864, 1969. 323 p, 310 ref.

Descriptors: *Bibliographies, *Hydrology, *United States, Hydrologic data, Publications, Water resources, Groundwater, Surface waters, Hydraulics.
Identifiers: *Canada.

References to books, journal articles, and other publications in hydrology published in the U.S. in 1964 are listed. Some references are taken from international journals. Previous bibliographies prepared by various organizations are listed. Citations are listed alphabetically by author, with full title and publication data. The index combines subject and geographic headings. (Knapp-USGS)
W69-07517

DIGITAL SIMULATION OF CHANNEL NETWORKS,
IBM Watson Research Center, Yorktown Heights, N. Y.
J. S. Smart, A. J. Surkan, and J. P. Considine.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 87-98, 1967. 12 p, 3 fig, 4 tab, 13 ref.

Descriptors: *Synthetic hydrology, *Stochastic processes, *River systems, *River basins, *Computer programs, Computer models, Digital computers, Statistical methods, Monte Carlo method, Probability.
Identifiers: Random walk method.

The random-walk method proposed by Leopold and Langbein for simulating channel networks has been programmed for a digital computer. Rules for generating the patterns are described in detail and a flow chart of the program is given. Analysis of about 600 networks produced by the program shows that the means and ranges of dimensionless geomorphological parameters are very similar to those observed in real stream systems. The stream number distributions for the simulated networks are in fair agreement with Shreve's theory but there are systematic deviations. Analysis of length distribution data suggests that first order streams in actual networks have an exponential length distribution. (Knapp-USGS)
W69-07542

DISCHARGE AS RELATED TO STREAM SYSTEM MORPHOLOGY,
Illinois State Water Survey, Urbana.
John B. Stall, and Yu-Si Fok.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 224-235, 1967. 12 p, 7 fig, 1 tab, 11 ref.

Descriptors: *Channel morphology, *Discharge (Water), *Illinois, Meanders, Geomorphology, Slopes, Alluvial channels, Banks, Beds, Depth, Shape, Slopes, Width, Channel erosion, Channel flow, Hydraulics, Regimes, Streamflow.
Identifiers: *Drainage basin morphology, Hortons law, Stream orders, Embarras River (Ill).

The basin of the Embarras River in Illinois is 2,400 sq mi in size and about 90% of the land is cultivated. The streams have relatively shallow gradients and the basin is typical of much of the mid-western USA. The Embarras has a drop of 317 ft throughout its course of 202 mi, for an average slope of 1.6 ft per mi. The morphological structure of the stream system has been analyzed using the Horton-Strahler stream ordering system. The stream network conforms to an excellent degree to the following laws of Horton: the law of stream numbers, the law of stream lengths, and the law of stream slopes. The sinuosity of streams in the basin is shown to increase geometrically with the stream order. Discharges at 8 stream gaging stations within the basin are shown to be related to stream order and to the frequency of occurrence of the discharge. Discharge measurements of the 8 stream gaging stations provide rating curves through which other hydraulic factors of the stream can be related to stream order. (Knapp-USGS)
W69-07547

THE INFLUENCE OF VEGETATION ON CHANNEL FORM OF SMALL STREAMS,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.; and Johns Hopkins Univ., Baltimore, Md. Dept. of Geography.
R. C. Zimmerman, J. C. Goodlett, and G. H. Comer.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 255-275, 1967. 21 p, 8 fig, 3 tab, 9 ref.

Descriptors: *Channel morphology, *Vegetation effects, Streamflow, Stage-discharge relations, Roughness (Hydraulic), Retardance, Slopes, Width, Depth, Channel flow, Bank erosion, Erosion, Sediment yield.
Identifiers: Channel forms, Bank shear strength.

Data on channel width of several small streams in the Sleepers River basin of northern Vermont show the influence of vegetation on channel form. Channel width in small streams is clearly related to type of vegetation, as channels are alternately wide under forest and narrow in sod. Along one stream, width increases in response to increases in discharge where the drainage area exceeds 0.3 sq mi, but the variability in width also increases, reaching a maximum where the drainage area is about 2 sq mi. Relatively uniform channel widths occur where the drainage area is about 6 sq mi. Similar relationships were found in other streams sampled. In the Sleepers River basin there are apparently 2 thresholds along streams. In a downstream direction, the first threshold occurs where drainage areas are 0.2 to 0.8 sq mi. Upstream from the threshold width does not increase with discharge, living tree roots cross the channel, and dams of organic debris are common. The flow is commonly underground. Where drainage areas are 0.2-0.8 sq mi, annual high flows are 10 to 20 cfs. With drainage areas exceeding 0.2-0.8 sq mi, widths increase, but channel form is highly variable, and mean channel widths may vary by as much as 5 feet depending upon the type of vegetation. Relatively uniform channel widths occur, regardless of vegetation, where the drainage areas exceed 4 to 6 sq mi. Drainage areas about 5 square miles are apparently the second threshold. These have annual high flows in the range of 100 to 150 cfs. With higher discharge, the influence of vegetation on channel form is marginal compared with that of geologic differences and the sinuousity of the flow itself. Vegetation influences channel form by varying the roughness and shear strength of bed and banks. (Knapp-USGS)
W69-07550

OBSERVATIONS ON UNMEASURED RIVERS,
Geological Survey, Washington, D. C.
Luna B. Leopold, and Herbert E. Skibitzke.
Geogr Ann, Vol 49, Ser A, No 2-4, pp 247-255, 1967. 9 p, 9 fig, 2 tab, 2 ref.

Descriptors: *Water measurement, *Surveys, *Hydrologic data, Streamflow, Stream gages, Current meters, Depth, Hydrographs, Discharge measurment, Estimating, Stage-discharge relations, Rivers, Water levels, Hydraulics, Discharge (Water).
Identifiers: Ungaged rivers, Streamflow estimation.

An analysis of data on hydraulic parameters collected during single boat trips down river systems is

presented, plotted in form of the hydraulic geometry. The data were taken on 2 separate boat trips down rivers. In one, no previous measurements were available but there is 1 gaging station downstream; the river studied is the John River, Alaska. The other river is the Middle Fork of the Salmon River, Idaho, Snake River system, from Dagger falls to the Salmon River, assistance of about 100 mi. In this basin there are several gaging stations, but the records from these were studied only after the field expedition was over. A dimensionless rating curve is used to estimate bankfull and average discharge for basins of various sizes. When compared with gaging station data, estimates of bankfull discharge are as consistent and possibly are equal in accuracy to estimates made from gaging station data. Estimates of average discharge are less consistent; within the range of drainage areas represented by the gaging stations, errors of estimate vary from 0 to 58%. Local variations of bed material size along the river are compensated mostly by changes in local channel slope and roughness and do not much affect the progressive downstream changes in width, depth, or velocity. (Knapp-USGS)
W69-07551

2F. Groundwater

THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW, 3. QUANTITATIVE INTERPRETATIONS,
R. Allan Freeze, and P. A. Witherspoon.
Water Resources Research, V 4, No 3, pp 581-590, June, 1968. 10 p, 3 fig, 13 ref.

Descriptors: *Mathematical models, *Basins, *Groundwater movement, Arid lands, Subsurface drainage, Water balance, Watersheds (Basins), Darcy's law, Flow nets, Safe yield, Groundwater recharge, Discharge (Water), Digital computers, Water resources development.

The natural basin ground water yield can be calculated from a quantitative analysis of the flow net obtained from a digital computer solution to a numerical mathematical model of the basin. The natural basin yield can be considered as a measure of the groundwater recharge to the basin and a conservative estimate of the safe yield. Rates of groundwater recharge and discharge vary geographically within a basin; positions of concentration can be determined by quantitative analysis. Quantitative interpretation of groundwater flow nets can play an important role in the calculation of basin-wide water balances. These methods can be useful in planning the development of many arid or semi-arid near-virgin basins in the American west and the Canadian prairies. (Sherbrooke-Ariz)
W69-07339

GRAVIMETRIC ESTIMATION OF DEPTH TO AQUIFERS IN THE HAZEVA AREA, ARAVA VALLEY, ISRAEL,
P. R. May.
Israel Journal of Earth-Sciences, v 17, no 1, pp 30-43, 1968. 14 p, 7 fig, 5 ref.

Descriptors: *Hydrologic aspects, *Gravity studies, Aquifer characteristics, Arid lands, Limestones, Geologic formations, Groundwater basins, Depth.
Identifiers: Arava Valley, Israel.

Aquifers in the Judea limestone extend from outcrops on the Negev uplands to the arid Hazeva area in the Arava Valley and eastward to the western border fault of the Dead Sea graben. A gravity survey shows the Hazeva area to be part of a shallow intermontane basin in which the Judea limestone lies at depths of 100 m. in the S.W. to 450 m. on the east. Depth estimations are made at six localities along the bounding faults by direct computation of the total anomaly caused and the maximum residual gradient. The principle density interface in the geologic column occurs at the top of the Judea limestone. The area east of the Sedom-Elat highway, but west of the badlands of Nahal Idan, is topographically the best suited to settlement and agriculture. A groundwater exploration drilling program should include penetration of the Cenomanian position, with wells drilled to at least 200 m. below the top of the limestone. (Sherbrooke-Ariz)
W69-07341

COMPOSITIONAL SIMILARITIES BETWEEN HOT MINERAL SPRINGS IN THE JORDAN AND SUEZ RIFT VALLEYS,
Israel Atomic Energy Commission, Rehovoth; and Weizmann Inst. of Science, Rehovoth (Israel).
Emanuel Mazor.
Nature, v 219, August 3, pp 477-478, 1968. 2 p, 2 fig, 7 ref.

Descriptors: *Hot springs, *Mineral water, *Aquifer characteristics, Water chemistry, Geologic control, Water temperature, Encroachment, Mixing, Saline water intrusion.
Identifiers: Jordan Rift Valley, Suez Rift Valleys.

The chemical composition of the Hammam Farun hot spring (72 deg C) in the Suez Rift Valley is found to be almost identical to that of the Tiberias Hot Springs (60 deg C) in the Jordan Rift Valley. The chemical nature of the Tiberias Hot Springs is hypothesized to result from a past oceanic invasion of the valley, whose waters reacted with the host rocks. The composition of Hammam Farun spring, 30 m. from the sea, is attributed to deep seawater mixing with local groundwater, having reacted with the host rock. Expected ionic changes are verified. Springs of the arid Jordan Rift Valley are thought to result from the continuous tectonic activity of the area forcing deep hot mineral waters to the surface. (Sherbrooke-Ariz)
W69-07342

OUTLINES OF GROUNDWATER RESOURCES OF SAUDI ARABIA,
Ministry of Agriculture and Water, Riyadh (Saudi Arabia).
Galip Otkun.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 16 p, 2 fig, 1 tab, 14 ref.

Descriptors: *Aquifer characteristics, Aquifers, Artesian wells, Deep wells, Depth, Discharge coefficient, Geologic formations, Groundwater recharge, Groundwater, Subsurface water, Karst, Hydrogeology, Natural recharge, Specific yield, Arid lands, Deserts.
Identifiers: Saudi Arabia.

A report on the characteristics and development of the groundwater resources of the desert Kingdom of Saudi Arabia, which lacks perennial rivers and has only scarce sporadic showers. In recent years hydrogeological investigations and drilling of more than a thousand production and exploratory wells revealed the existence of 16 aquifers, at least 10 of which are reliable and prolific. Nine of these are treated in detail, including information on geology, depth, transmissibility, number of wells, total dissolved solids, age, recharge, infiltration rate, geographic extent, and importance to the economy. Saudi Arabia which is very poor in surface water possesses rich groundwater resources. Included are a block diagram of geologic structures, a geologic map, and a table of aquifer characteristics. (Sherbrooke-Ariz)
W69-07354

HYDROGEOLOGICAL APPRECIATIONS OF THE PROVINCE OF LA RIOJA,
Mario V. J. Sosic.
International Conference on Water for Peace, Washington, D. C., 1967, Water for Peace, v 4 (Basic Data for Water Programs), p. 928-932, 1968. 4 p. For 8 volume proceedings see vol 2 no 9, field 06B, W69-03305.

Descriptors: *Hydrological aspects, *Arid lands, Streamflow, Aquifer characteristics, Depth, Groundwater basins, Hydrogeology, Hydrologic properties, Saline soils.
Identifiers: La Rioja Prov. (Argentina).

Situated in the arid Argentine Northwest, La Rioja Province possesses a considerable reserve of underground water, which is hardly exploited and not completely investigated. Economic progress first requires the rational use of surface waters. The following hydrogeologic zones are discussed: (1) the La Rioja Plains, (2) southern areas of Salar de Pipanaco, (3) the valley of river San Blas de los Sauces, (4) the alluvial cones of the rivers Santa Cruz, Campanas, Pituil, (5) Valley of Los Colorados Antinanco, (6) Valley of River Bermejo (7) the Pocket of Jague, and (8) Valley of Guandacol. Topics considered include quality of water, depth of water, demand for water, river systems, well yields, soil salinity, and regional economy. The 4 most propitious areas for rational underground water exploitation are indicated. (Sherbrooke-Ariz)
W69-07358

A GEOMETRIC METHOD TO SUBDIVIDE THE PATAPSCO FORMATION OF SOUTHERN MARYLAND INTO INFORMAL MAPPING UNITS FOR HYDROGEOLOGIC USE,
Maryland Geological Survey, Baltimore.
For primary bibliographic entry see Field 07B.
W69-07387

AN ESSENTIAL FACTOR IN THE NATURAL WATER CYCLE: THE RATE OF CIRCULATION IN PERMEABLE GROUNDS (FRENCH),
Strasbourg Univ. (France). Lab. of Fluid Mechanics.
L. Zilliox, A. Amirsadri, and C. Kopp.
Terres and Eaux, Rev Int de L' Hydraul, Vol 22, No 58, pp 29-34, Jan-Mar 1969. 6 p, 5 fig, 1 tab, 6 ref.

Descriptors: *Water circulation, *Velocity, *Groundwater, *Permeability, Model studies, Porous media, Tracers, Piezometers, Mathematical studies, Darcy's law, Filtration, Saturated flow, Runoff, Discharge (Water).
Identifiers: Underground water circulation, Permeability effect on water circulation.

This article describes the development and use on a laboratory model of special techniques of measurement of the rate of circulation of groundwater tables. More specifically, the purpose of the study was to determine, with satisfactory limits of probability, the time taken by a tracer to travel in a porous media from a point of emission to a reference point at a distance L. In carrying out the model studies, an injection shaft with a perforated piston allowing the instantaneous and limited injection of a chemical electrolyte tracer and a piezometer were used. The piezometer located downstream in the same line of flow served for the electrical detection of the tracer. The study shows that the combination of experimental model study with the use of hydraulic and optical methods serves for a more precise evaluation of groundwater velocities. (Gabriel-USGS)
W69-07391

WATER RESOURCES OF THE MILLERS RIVER BASIN, NORTH-CENTRAL MASSACHUSETTS AND SOUTHWESTERN NEW HAMPSHIRE,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-07406

GEOPHYSICAL AND GEOLOGICAL STUDIES OF THE RELATIONSHIPS BETWEEN THE DENVER EARTHQUAKES AND THE ROCKY MOUNTAIN ARSENAL WELL, PART A,
Colorado School of Mines, Golden. Dept. of Geophysics; and Colorado School of Mines, Golden. Dept. of Geology.

ohn C. Hollister, and Robert J. Weimer.
Colo School Mines Quart, Vol 63, No 1, Jan 1968. 51 p, 9 pap.

Descriptors: *Earthquakes, *Injection wells, *Waste disposal, *Colorado, Hydrostatic pressure, Fractures (Geology), Faults (Geology), Groundwater basins, Aquifers, Structural geology, Pore pressure.
Identifiers: Denver (Colo), Rocky Mountain Arsenal.

Earthquakes at Denver, Colorado cause public concern because they are apparently related to the operation of a deep waste-disposal well at the Rocky Mountain Arsenal. Seismograph studies, geological investigations, and study of deep-well records were financed and made to determine the origin and mechanisms of the earthquakes. It is the belief of the majority of the investigators that injection of liquid wastes contributes to earthquake activity. The effect of injection on earthquakes could not have been predicted when the well was drilled in 1961. The reservoir should be allowed to come to equilibrium without further injection or withdrawal of fluids. (Knapp-USGS)
W69-07410

PROPERTIES OF THE ROCKY MOUNTAIN ARSENAL DISPOSAL RESERVOIR AND THEIR RELATION TO DERBY EARTHQUAKES,
Colorado School of Mines, Golden. Dept. of Geophysics.
S. R. Pickett.
Colo School Mines Quart, Vol 63, No 1, pp 73-100, Jan 1968. 28 p, 12 fig, 6 tab, 10 ref, 1 append.

Descriptors: *Earthquakes, *Injection wells, *Waste disposal, *Colorado, Hydrostatic pressure, Fractures (Geology), Faults (Geology), Groundwater basins, Aquifers, Porosity, Permeability, Structural geology, Pore pressure.
Identifiers: *Rocky Mountain Arsenal, Denver (Colo).

Injection pressure and volume data of the Rocky Mountain Arsenal disposal well were studied to learn the physical properties of the reservoir and to correlate reservoir properties with the earthquake history of the area. The Rocky Mountain disposal reservoir contains a total fluid volume between 0.6 and 1.9 X 10 billion barrels. The total reservoir consists of several parts which have significantly different fluid permeabilities. The reservoir pressure before start of injection in 1962 was between 700 and 1400 psi subhydrostatic. After cessation of injection in 1966, the different parts of the reservoir were at different pressures, the most permeable part having the highest pressure (about 100 psi subhydrostatic). An empirical correlation exists for the injection history of the Arsenal well between cumulative number of earthquakes and calculated static reservoir pressure. A means for predicting the total number of earthquakes to be anticipated before the reservoir comes to pressure equilibrium is suggested. Empirical comparison of injection energy with earthquake magnitude shows that if injection energy is returned as earthquake energy, it is stored for significant lengths of time before release. If it is assumed that all injection energy has now been returned as earthquake energy, then the total energy magnitude is consistent with energy-earthquake magnitude relations proposed by Richter. (Knapp-USGS)
W69-07411

HYDRAULIC CHARACTER OF FRACTURED METAMORPHIC ROCKS OF THE FRONT RANGE AND IMPLICATIONS TO THE ROCKY MOUNTAIN ARSENAL WELL,
Colorado School of Mines, Golden. Dept. of Geology.
David T. Snow.
Colo School Mines Quart, Vol 63, No 1, pp 167-199, Jan 1968. 33 p, 13 fig, 27 ref.

Descriptors: *Earthquakes, *Injection wells, *Waste disposal, *Colorado, Hydrostatic pressure, Fractures (Geology), Faults (Geology), Groundwater basins, Aquifers, Porosity, Permeability, Transmissivity, Aquicludes, Structural geology, Pore pressure.
Identifiers: Rocky Mountain Arsenal, Denver (Colo).

Hydraulic and geometrical properties of fractured metamorphic rocks of the Front Range of Colorado are determined from damsite pressure-injection tests and records of domestic water wells. Since these same rocks beneath the Denver basin comprise the reservoir into which fluid wastes have been injected at the Rocky Mountain Arsenal Well, the Front Range properties are applicable to studies of the Arsenal well injection performance and the possible earthquake response. Fracture permeability may be of like origin in both cases: faulting, weathering and erosional stress release beneath a surface of erosion. At damsites in the Front Range metamorphic rocks, fracture spacing is about 5 to 10 ft near the ground surface, increasing to about 15 to 35 ft at the 200-ft level. Water wells intercept even fewe. significant fractures. Openings close from about 200 microns to about 70 microns between the near-surface and 200-ft depth and porosites decrease from about 0.04% to 0.001%. The logarithm of permeability decreases linearly with the logarithm of depth. The fractured aquifer is a thin skin draped over the terrane. Test data suggest that the aquifer is bounded by vanishing permeability at about 200 ft, though open fault zones may extend to greater depths. Different lithologic units have different transmissibilities. These exceed the transmissibilities deducted from Arsenal well flow, so the pre-Pennsylvanian soils and sediments resting on the gneiss at the well site may effectively confine flow to the fractured basement. (Knapp-USGS)
W69-07412

FRACTURE DEFORMATION AND CHANGES OF PERMEABILITY AND STORAGE UPON CHANGES OF FLUID PRESSURE,
Colorado School of Mines, Golden. Dept. of Geology.
David T. Snow.
Colo School Mines Quart, Vol 63, No 1, pp 201-244, Jan 1968. 44 p, 10 fig, 43 ref.

Descriptors: *Earthquakes, *Injection wells, *Waste disposal, *Colorado, Hydrostatic pressure, Fractures (Geology), Faults (Geology), Stress, Groundwater basins, Aquifers, Porosity, Permeability, Water storage, Transmissivity, Aquicludes, Structural geology, Pore pressure.
Identifiers: Rocky Mountain Arsenal, Denver (Colo).

Fractures are non-rigid fluid conductors of such small size that changes of the openings with changes of pressure result in appreciable changes of permeability and account for the major portion of storage. Plane vertical strain is assumed in the derivation of an equation of transient flow, but in radial cases, such as the Rocky Mountain Arsenal Well injection, the distributions of stress, permeability, and hydraulic potential are interrelated. A deformability coefficient for fractures in the Front Range metamorphic rocks at Bergen Park, Colorado, is deduced from strain measurements near a water-supply well which drains the fracture system. Effective stress changes consequent to fluid-pressure changes may have significance to the question of the earthquake mechanism, especially if geological evidence, such as faulting, points to a critical state of tectonic stress. From the time of latest faulting in the Denver basin probably criticality may have been maintained by erosional release of confinement, suggesting that the fractured basement is prone to failure upon injection of fluids. (Knapp-USGS)
W69-07413

HYDRODYNAMIC STUDY OF THE WESTERN DENVER BASIN, COLORADO,
Petroleum Research Corp., Denver, Colo.
Roger L. Hoeger.
Colo School Mines Quart, Vol 63, No 1, pp 245-251, Jan 1968. 7 p.

Descriptors: *Earthquakes, *Injection wells, *Waste disposal, *Colorado, Hydrostatic pressure, Potentiometric level, Fractures (Geology), Faults (Geology), Groundwater movement, Stress, Groundwater basins, Aquifers, Porosity, Transmissivity, Aquicludes, Structural geology, Pore pressure.
Identifiers: Rocky Mountain Arsenal, Denver (Colo).

The original hydrostatic pressure in the fracture system of Precambrian basement rocks in the Rocky Mountain Arsenal well was far below normal. In an effort to understand the reasons for the subnormal pressure, a study of hydrodynamic pressure gradients in overlying sedimentary rocks of the western Denver basin was considered necessary. An analysis of all available data on the major deep aquifers is presented. A barrier trend, which may be caused by a fault system of regional extent, is present between the areas of high potential and the majority of the area studied which is typically at much lower potential. (Knapp-USGS)
W69-07414

HYDROLOGY OF SOME SMALL GROUNDWATER BASINS IN IDAHO,
Idaho Univ., Moscow. Dept. of Geology.
Robert W. Jones.
Idaho Water Resources Research Institute, Termination Report, February, 1968. 7 p, 4 ref. OWRR Project A-020-IDA.

Descriptors: *Ground water, Hydrologic models, Hydrologic data, *Experimental ground water basins.

One basin has been studied (Albion basin, Cassia County, Idaho) and the results published as an open file report by the Idaho Bureau of Mines and Geology. Aquifers were delineated, water-table mapped, and preliminary evaluation of the groundwater flow pattern was obtained. Wells range in depth from 11 feet to 700 feet and yields range up 540 gpm. Clay lenses in alluvium create local artesian aquifers. The water can be classified as calcium bicarbonate type and is suitable for domestic and irrigation use. The total dissolved solids content range from 202 ppm to 2294 ppm. Hot springs exist in the Marsh Canyon area. The study should serve as a basis for further investigations utilizing experimental approaches.
W69-07459

DETAILED GROUND WATER INVESTIGATION OF MOSCOW BASIN,
Idaho Univ., Moscow. Dept. of Geology.
Robert W. Jones, and Sylvia H. Ross.
Idaho Water Resources Research Institute Research Technical Completion Report, June, 1969, Moscow, Idaho, 12 p, 3 fig, 11 ref. OWRR Project A-011-IDA.

Descriptors: *Ground water, *Basalt, *Sedimentary interbeds, *Columbia River Group, *Type area, *Small ground water basins, Field pumping tests, *Mathematical models, Artesian aquifers, *Recharge, *Storage, Coefficient of transmissibility, Coefficient of storage, *Artificial recharge, Intermittent streams, *Iron in water.

Moscow basin, a 58 square-mile, U-shaped basin with a 12 square-mile central lowland underlain by basalt flows and sedimentary interbeds of the Columbia River Group, is a type area for the study of the small ground water basins underlain by basalt that are common in the Pacific Northwest. Because field pumping tests were not practical, mathematical models of the artesian aquifers were designed. Comparison of the performance of the model aquifers with that of the real aquifers indicates that, if no recharge is taking place, ground water in storage will meet the needs of the basin until 2050 or 2100. However, values of coefficient of transmissibility ('T') and coefficient of storage

('S') are very high in the no-recharge models. If the real values are significantly lower, then considerable recharge is taking place. No studies have been made of models that receive recharge. Model studies were used to demonstrate the feasibility of artificial recharge utilizing seasonal runoff of intermittent streams. High contents of iron in waters in parts of the artesian aquifers are the result of naturally recharging waters carrying in iron from weathered bedrock on the margins of the basin.
W69-07460

HYDROLOGY OF NEOGENE DEPOSITS IN THE NORTHERN GULF OF MEXICO BASIN,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 02L.
W69-07467

A RECONNAISSANCE OF THE GROUND-WATER GEOLOGY OF MONTVILLE TOWNSHIP, MEDINA COUNTY, OHIO,
Kent State Univ., Ohio. Dept. of Geology.
For primary bibliographic entry see Field 04B.
W69-07492

PALEOHYDROGEOLOGICAL ANALYSIS PRINCIPLES OF ARTESIAN BASINS (RUSSIAN),
Ministry of Geology.
A. N. Sultankhodzhayev, V. G. Tyminskiy, N. A. Surganova, and I. M. Rosanova.
(Geol J of Uzbek), No 1, pp 49-53, 1969. 5 p, 1 tab, 8 ref.

Descriptors: *Paleohydrology, *Analysis, *Artesian wells, *River basins, Chemical analysis, Water chemistry, Groundwater, Porosity, Hydrogen, Oxygen, Radioactivity, Mineral water, Mathematical studies, Helium, Radioisotopes, Deuterium, Chlorine, Sulfides, Aquifers, Fissures (Geology).
Identifiers: Paleohydrogeological analysis, Artesian basins.

On the basis of a formula developed by V. G. Tyminskiy and his associates (1966) and using the He/Ar method, the chemical analyses of the fresh and mineralized parts of the artesian basin waters and the relative age of these parts was made by using the aquifers of Tashkent, Fergana and Kyzyl Kum areas. The study shows that by assuming the existence of three genetic groups characterized by their chemical composition, their paleogeographic, geographic and other parameters, the paleohydrological material should be of value. It should give not only the ratio of groundwater in a mixture, but the ratio of infiltrated water in the mixture, as well. The use of the He/Ar method guarantees a reliable determination of the age of waters taking part in the mixture. (Gabriel-USGS)
W69-07500

HYDROLOGIC RESPONSE TO IRRIGATION PUMPING IN HUALAPAI FLAT, WASHOE, PERSHING, AND HUMBOLDT COUNTIES, NEVADA, 1960-67,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 04B.
W69-07501

GEOHYDROLOGY AND WATER UTILIZATION IN THE WILLCOX BASIN, GRAHAM AND COCHISE COUNTIES, ARIZONA,
Geological Survey, Washington, D. C.
S. G. Brown, and H. H. Schumann.
Geol Surv Water-Supply Pap 1859-F, pp F1-f32, 1969. 32 p, 7 fig, 3 plate, 2 tab, 17 ref.

Descriptors: *Water resources, *Water utilization, *Groundwater, *Arizona, Groundwater movement, Recharge, Discharge (Water), Evapotranspiration, Streamflow, Water yield, Transmissivity, Specific capacity, Hydrogeology, Groundwater basins.
Identifiers: Willcox basin (Ariz).

The Willcox basin is an area of interior drainage in Cochise and Graham Counties, Arizona. The basin comprises about 1,500 sq mi, of which the valley floor occupies about 950 sq mi. Even in areas where the consolidated rocks are fractured and jointed, only small amounts of water have been developed. The rocks of the basin consist of alluvium, in which lenticular sand and gravel layers interbedded in silt-and clay-size material constitute the principal aquifer. The median specific capacity of wells ranges from 7.4 to 20 gpm/100 ft of saturated material penetrated. The coefficient of transmissibility of the aquifers ranged from 58,000 to 160,000 gpd/ft. The estimate of the evapotranspiration in the playa area before large-scale development was about 75,000 acre-ft/yr. Underflow toward the playa was computed to be about 54,000 acre-ft/yr. Ground water has been used for irrigation since 1910. In 1928, about 4,000 acre-ft of groundwater was pumped, and by 1963 180,000 acre-ft/yr was being pumped. Water-level declines for 1962-63 exceeded 10 ft/yr in some wells in the more heavily pumped Kansas Settlement area and 7 ft/yr in the Stewart area. (Knapp-USGS)
W69-07506

REGIONAL HYDROGEOLOGY OF THE NAVAJO AND HOPI INDIAN RESERVATIONS, ARIZONA, NEW MEXICO, AND UTAH,
Geological Survey, Washington, D. C.
M. E. Cooley, J. W. Harshbarger, J. P. Akers, W. F. Hardt, and O. N. Hicks.
Geol Surv Prof Pap 521-A, pp A1-A61, 1969. 61 p, 20 fig, 5 plate, 8 tab, 124 ref.

Descriptors: *Hydrogeology, *Water resources, *Groundwater, *Arizona, *New Mexico, Colorado, Utah, Groundwater movement, Recharge, Discharge (Water), Transmissivity, Permeability, Specific capacity, Aquifers, Water wells, Water quality, Hydrologic data, Water levels.
Identifiers: Navajo-Hopi Indian reservation.

The Navajo and Hopi Indian Reservations have an area of about 25,000 sq mi and are in the south-central part of the Colorado Plateaus. The underlying sedimentary rocks range in age from Cambrian to Tertiary and the Igneous and metamorphic basement rocks are of Precambrian age. The climate varies widely, ranging from semiarid below 4,500 ft to relatively humid above 7,5000 ft. Precipitation has a strong and fairly uniform relation to altitude. The Colorado and San Juan Rivers are perennial, but most of other streams are ephemeral or intermittent. Nearly 1/6 of the area drains internally. The aquifers are composed of beds of sandstone and mudstone. The main aquifers are in the Coconino Sandstone, Navajo Sandstone, and the alluvium; but all other units locally yield some water to wells and springs. Coefficients of permeability are generally less than 10 gpd per sq ft, and many are less than 3 gpd per sq ft. Yields from wells in these aquifers usually are less than 25 gpm. Most specific capacities computed from tests of wells range from 0.3 to 5.0 gpm per ft of drawdown. The dissolved-solids content of 1,300 water samples analyzed ranges from 90 to more than 25,000 ppm. Water having the greatest amount of dissolved solids is in deep aquifers in the Black Mesa and San Juan basins. (Knapp-USGS)
W69-07512

WATER RESOURCES OF WINDWARD OAHU, HAWAII,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-07516

BIBLIOGRAPHY OF HYDROLOGY OF THE UNITED STATES AND CANADA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-07517

GEOLOGY AND GROUND-WATE RESOURCES IN THE RALEIGH AREA, NOR CAROLINA,
Geological Survey, Raleigh, N. C.
V. Jeff May, and J. D. Thomas.
NC Dep Water Resources Ground Water Bull 15, Nov 1968. 135 p, 26 fig, 32 tab, 23 ref.

Descriptors: *Water resources, *North Caroli *Groundwater, Water wells, Water yield, Aquife Fractures (Geology), Permeability, Discha (Water), Data collections, Hydrologic data, Wa quality, Water levels.
Identifiers: Raleigh Area (NC).

Several towns and industries in the Raleigh area, C. obtain their water supplies from wells. Grou water is the source for all private supplies. T permeability of the rock units depends largely up the occurrence of secondary interstices such fractures and cleavage planes. Because the natu and abundance of these interstices vary in the d ferent rock types, the yields of wells differ grea from place to place. The yield of wells in all of metamorphic and igneous rocks, except gre stone, ranges from 12 to 22 gpm. Adequ domestic supplies and small to moderate industr and municipal supplies are obtained from th rocks. Most wells in Triassic rocks yield less th 10 gpm. The average yield of wells in draws greater than twice the average yield of wells other topographic locations. The permeability the rocks decreases with depth. Generally, lit water is contained in the rocks below a depth 200 to 250 ft. Groundwaters in the Raleigh area mostly calcium and sodium bicarbonate type wat Some highly mineralized waters for this area produced from the Triassic and metavolca rocks. The bromide concentration in groundwa is probably from residual sea water. The w waters containing above-normal amounts of nitr in the area have been polluted because of improp well casing. (Knapp-USGS)
W69-07519

KARSTIC PHENOMENA (FRENCH).
P. Fenelon.
Mem et Doc, Centre Rech et Doc, Cartogr Geogr, NSF, Paris, France, Vol 4, New Ser, 19 378 p. Texts in French.

Descriptors: *Karst, *Mapping, *Hydrologic p perties, Maps, Geomorphology, Carbonates, Wa chemistry, Geology, Calcium compounds, D solved solids, Topography, Tropical regions, Te perate.
Identifiers: Karstic phenomena.

This book is a comprehensive report on the kars phenomena and consists of 14 articles as follo (1) French vocabulary of karstic phenomena; large scale maps of karstic phenomena; (3) Ca de Caylus map of karstic phenomena; (4) plains Verdon map of karstic phenomena; geomorphologic map of the Caussols, Calern, a La Malle plateaus; (6) carbonate chemistry a karstic hydrology; (7) the origin of decalcificati clays; (8) karstic morphology of the eastern part the Monts de Vaucluse; (9) dissolution curve calcareous rocks in the mountains of the Medit ranean area; (10) eastern Mediterranean kars phenomena; (11) the depressions of the Cent Moroccan Atlas; (12) the development of kars relief in tropical and temerate regions; geomorphological notes on karstification of B bados (Antilles); and (14) the morphology of c careous areas of Jamaica and Puerto Ri (Gabriel-USGS)
W69-07552

BASE OF FRESH GROUND WATER SOUTHERN OKLAHOMA,
Geological Survey, Washington, D. C.
Donald L. Hart, Jr.
Geol Surv Hydrol Invest Atlas HA-223, 2 shee 1966. Text, 5 map, 4 charts.

Descriptors: *Groundwater, *Saline water-freshwater interfaces, *Oklahoma, Brines, Water quality, Water yield, Water wells, Aquifers, Permeability, Recharge, Groundwater movement.
Identifiers: Saline groundwater.

The altitude of the base of fresh groundwater in southern Oklahoma is shown by maps and cross sections in a 2-sheet hydrologic atlas. The base of fresh water was determined from electric logs of deep wells, drillers' logs of water wells, and from published reports. Its depth varies from within a few feet of the surface to over 3000 ft below the surface, and depends on the depth of the rocks, their permeability and solubility and source of recharge. Areas of deepest fresh water occur in moderately to steeply dipping permeable rocks with large recharge capability. In poorly permeable rocks, the fresh water-salt water interface is sharp, and in more permeable rocks there is a broad gradational zone. (Knapp-USGS)
W69-07553

A NUMERICAL TECHNIQUE FOR AQUIFER ANALYSIS,
Illinois Univ., Urbana; and Nova Scotia Dept. of Mines, Halifax.
J. D. Bredehoeft, and George F. Pinder.
Proc, Nat Symp Anal Water-Resource Syst, pp 21, Denver, July 1968. 1 p.

Descriptors: *Numerical analysis, *Analytical techniques, *Aquifers, Aquifer characteristics, Groundwater movement, Mathematical models, Digital computers, Pumping, Water distribution (Applied), Water levels, Regional analysis.
Identifiers: Differential equations, Nova Scotia.

A summary of a report on mathematical model which determined the flow characteristics of an aquifer was given. The unsteady flow of groundwater in an aquifer was described by elliptic and parabolic partial-differential equations which could be approximated by finite equations. The solution of the finite difference equations for a non-homogeneous, anisotropic, leaky-artesian aquifer with irregular boundaries, differing boundary conditions, and multiple variable-rate pumping (or recharge) wells was discussed. The method used for solving the equations in two-space dimensions with time was the alternating direction implicit technique. Several comparisons of the numerical solutions versus analytical solutions were presented. Results of a digital analysis of an aquifer at Musquodoboit Harbor, Nova Scotia, were presented. Several other applications were listed. It was concluded that the numerical technique made possible rapid analysis of groundwater flow systems, and to use such models as a base from which to optimize the total system. For main entry see W69-07562. (Gysi-Cornell)
W69-07569

2G. Water in Soils

THE ASPHALT MOISTURE BARRIER FOR FARMING DROUGHTY SOILS,
International Harvester Co., Chicago, Ill. Product Planning Research; and American Oil Co., Whiting, Ind. Research and Development Dept.
For primary bibliographic entry see Field 03B.
W69-07344

INDEPENDENT MEASUREMENT OF MATRIC AND OSMOTIC POTENTIAL OF SOIL WATER,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
J. D. Oster, S. L. Rawlins, and R. D. Ingvalson.
Soil Sci Soc Amer Proc, Vol 33, No 2, pp 188-192, Mar-Apr 1969. 5 p, 3 fig, 15 ref.

Descriptors: *Osmotic pressure, *Water chemistry, Solutes, Moisture stress, Density, Soil water movement, Diffusion, Instrumentation, Tensiometers, Moisture tension.
Identifiers: Matric potential (Soil water), Salt exclusion, Psychrometry.

A technique is described that uses the operating principles of the thermocouple psychrometer and the porous plate apparatus to measure the matric and osmotic potentials of soil water without extraction of a significant amount of soil solution. The technique was tested on a Na-saturated Gila soil to which NaCl solutions with osmotic potentials of -1, -2, and -6 bars were added. The standard error of measurement of the soil water potential components was about 0.04 bar. The measured osmotic potentials of the soil were lower than those of the added solutions, which can be explained by salt exclusion although mineral dissolution could contribute to these results. The technique also permitted measurement of the partial molar volume of soil water with an accuracy of about 1%. Within this precision, the partial molar volume of soil water in this study was shown to be the same as that of pure water. (Knapp-USGS)
W69-07374

EVALUATING RANGELAND WATER QUALITY WITH SMALL PLOT INFILTROMETERS,
Utah State Univ., Logan. Dept. of Watershed Science; and Intermountain Forest and Range Experiment Station, Ogden, Utah.
For primary bibliographic entry see Field 03F.
W69-07377

EFFECTS OF SOIL PHYSICAL PROPERTIES, RAINFALL CHARACTERISTICS, AND WIND VELOCITY ON CLOD DISINTEGRATION BY SIMULATED RAINFALL,
Agricultural Research Service, Manhattan, Kans. Div. of Soil Erosion.
Leon Lyles, L. A. Disrud, and N. P. Woodruff.
Soil Sci Soc Amer Proc, Vol 33, No 2, pp 302-306, Mar-Apr 1969. 5 p, 4 fig, 9 tab, 9 ref.

Descriptors: *Infiltration, *Rainfall-runoff relationships, *Impact (Rainfall), *Puddling, *Soil structure, *Simulated rainfall, *Wind velocity, Soil texture, Runoff, Erosion, Permeability, Rainfall simulators, Hydraulic models.
Identifiers: *Clod disintegration, Raindrop energy.

The effects of clod size and density, rainfall intensity and duration, and wind velocity on clod disintegration by simulated rainfall were studied in a laboratory wind tunnel-raintower facility. Significant interactions (including those of higher order) were found among the variables studied. Clod bulk density had a minor effect on disintegration. For a specific clod size and wind velocity, 10-min rains at 5.61 cm/hr were about as destructive as 90-min rains at 1.60 cm/hr, even though the total volume of rainfall was 2.5 times larger in the latter case. Wind-driven rain was very effective in clod disintegration. Up to 66% more soil was lost from clods exposed to 13.4-m/sec winds than those exposed to no wind for the same rain intensity, duration of exposure, and clod size. Mean drop size striking the clods probably increases with wind velocity and would account for some of the wind effects. Small clods were more susceptible to disintegration by raindrop impact than large clods. Multiple regression analyses indicate about 80 and 89% of the soil detachment variance was accounted for by linear and curvilinear procedures respectively. (Knapp-USGS)
W69-07378

PIEZOMETER DETECTION OF SATURATED INTERFLOW IN SOILS,
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 07B.
W69-07463

HYDROLOGY OF NEOGENE DEPOSITS IN THE NORTHERN GULF OF MEXICO BASIN,
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 02L.
W69-07467

2H. Lakes

POTENTIAL POLLUTIONAL EFFECTS IN DEEP LAKES,
Environmental Control Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 05C.
W69-07363

PLANKTONIC AND BENTHIC BACTERIA OF LAKES AND PONDS,
Windham Coll., Putney, Vt.
Louise F. Potter.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 148-166. 11 tab, 22 ref, disc.

Descriptors: *Plankton, *Bacteria, *Benthic flora, *Aquatic environment, Water, Mud, Surfaces, Storage, Irrigation water, Lakes, Ponds, Alkaline water, Fish, Plants, Algae, Depth, Chlorophyll, Ammonium compounds, Vitamin B, Spores, Amino acids, Yeasts, Soil water.
Identifiers: Aufwuchs group, Montana, Flathead Valley, Mission Valley, Chromogen, Stone, Gram stain, Carex sp, Potamogeton sp, Sedge, Arthrobacter.

Planktonic and benthic populations differ morphologically, especially in Gram reactions. Size and proportion of organism types in each group vary with environment changes. The Aufwuchs group, growing on stones, stumps, plants, and fish, resembles the planktonic more than the benthic. Bacteria in lakes (oligothrophic and eutrophic) and ponds (eutrophic or dystrophic) are compared. Surface water showed large fluctuations in the number of bacteria in proportion to chromogens. Areas within lakes, rather than lake types (oligotrophic or eutrophic) appeared significant. Benthic bacterial populations are in inverse proportion to depth of water above mud. Indications are that bacteria do not decompose materials as rapidly as they are being deposited. There seem to be autochthonous floras for water and mud. Although no distinct patterns of vertical distributions emerge, the surface contains the largest populations. Chromogens predominate at all levels. Red-pigmented and pink-pigmented organisms were most numerous in surface water. Gram-positive spore-formers were more frequent in mud than in water. Fish are carriers of bacteria. The alkalinity, inorganic and organic compounds, including vitamins, affect bacterial populations, B vitamins increasing the percentage of chromogens. Percentage of chromogens was an indicator of the planktonic group. For main entry see W69-07423. (Jones-Wisc)
W69-07432

THE ECOLOGICAL ROLE OF PHOSPHORUS IN WATERS WITH SPECIAL REFERENCE TO MICROORGANISMS,
Dalhousie Univ., Halifax, Nova Scotia. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W69-07435

THE EXCHANGE OF DISSOLVED SUBSTANCES BETWEEN MUD AND WATER IN LAKES,
Freshwater Biological Association, Ambleside (England).
Clifford H. Mortimer.
Journal of Ecology, Vol 29, pp 280-329, 1941. 21 fig, 2 tab.

Descriptors: *Mud, *Sediment-water interfaces, *Lakes, *Water chemistry, Reduction (Chemical), Oxidation, Adsorption, Aeration, Anaerobic conditions, Hypolimnion, Nutrients, Diffusion, Water

transfer, Iron, Ammonia, Phosphates, Oxygen, Color, Alkalinity, Eutrophication, Cycling nutrients.
Identifiers: *Mud-water exchange, Esthwaite water, Dissolved ions, Reduction potential, Artificial mud-water systems, Chemical stratification, Isopleths, Time-depth diagrams, Concentration gradient, Overturn.

Distribution of physical variables and dissolved substances in Esthwaite by depth-time are diagrammed. Vertical chemical stratification in water column suggests that main agents of production or depletion are located at mud's surface. Movement of water masses in hypolimnion is mainly horizontal and sufficient to maintain eddy diffusion coefficient and spread rate of dissolved substance exceeding molecular diffusion by 2000-fold. Hypolimnion activity in Esthwaite suggests an applicable hypothesis to lakes in which deoxygenation occurs. Oxygen depletion triggers nitrate reduction at an early stage. A second stage at redox approximately E-sub-7x 0.25 volt destroys insoluble ferric complexes existing at mud-water interface and liberates bases, including ammonia, ferrous iron, and other reducing materials. At third stage, ion concentrations increase gradually until oxygen is reintroduced at overturn. Depth-time of redox potential and electrical conductivity from two artificially aerated and anaerobic mud-systems were diagrammed to compare variations in dissolved substances. After oxidized surface layer disappeared in anaerobic tank, rapid rise in iron, ammonia, silicate, phosphate, alkalinity and conductivity occurred. In aerated tank, little change occurred in concentrations of dissolved substances apart from accelerated decrease of pH, alkalinity, nitrate, and ammonia, and subsequent slow rise in sulfate and conductivity. (Bortleson-Wisc)
W69-07438

A THREE DIMENSIONAL STUDY OF PARAMETERS RELATED TO THE CURRENT DISTRIBUTION IN LAKE ROOSEVELT,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
Robert T. Jaske, J. C. Sonnichsen, and C. A. Oster.
Battelle Memorial Inst NW Lab Res Rep to OWRR, Dept of Interior, Apr 23, 1969. 93 p, 35 fig, 10 tab, 32 ref, 5 append. AEC Contract No. AT (45-1)-1831. Available from Clearinghouse as PB 184 700 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Lakes, *Reservoirs, *Currents (Water), *Density stratification, *Mathematical models, Computer programs, Density, Temperature, Turbulence, Current meters, Data collections, Remote sensing, Streamflow, Operations research, Systems analysis.
Identifiers: *Lake Roosevelt (Wash), Jet currents, Savonious current meter.

Research was undertaken to describe the physical relationship of the current field to the stratification pattern in Lake Roosevelt. The higher temperatures in the penstock discharge were related to the mean temperature of water in the entrance flow field. This condition persists for many miles upstream so that the mean temperature of the moving water mass is represented by a temperature from 10 to 20 m above the location of maximum current speed. A correlation of the position of the depth of the jet with the densimetric Froude number was obtained. The use of the Savonious rotor current meter was demonstrated to be appropriate for the flow field under study, with current speeds of from 0.025 to 0.35 knots. Second order instabilities in the current speeds were determined and standard deviation estimated, but no theory supporting the existence of these instabilities was advanced. A 2-dimensional, semi-empirical mathematical model was developed as a basis for further operations research. The relationship of the flow field at Lake Roosevelt to that of the Arrow Lakes was detailed, and distinct similarities were noted in portions of similar depth. A theory is proposed to guide computations of the depth of the flow field involved in the travel of surface water over a spillway or submerged obstacle. Computer program listings are included. (Knapp-USGS)
W69-07481

A NONLINEAR MODEL OF THE FLOW OF AN INHOMOGENEOUS FLUID AT THE EQUATOR (RUSSIAN),
Akademiya Nauk SSSR. Institut Okeanologii.
For primary bibliographic entry see Field 02A.
W69-07529

2J. Erosion and Sedimentation

LANDWARD TRANSPORT OF BOTTOM SEDIMENTS IN ESTUARIES OF THE ATLANTIC COASTAL PLAIN,
Geological Survey, Woods Hole, Mass.
For primary bibliographic entry see Field 02L.
W69-07380

CONSOLIDATION AND CEMENTATION OF RECENT SEDIMENTS IN THE ATCHAFALAYA BASIN,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
Clara Ho, and James M. Coleman.
Geol Soc Amer Bull, Vol 80, No 2, pp 183-191, Feb 1969. 9 p, 5 fig, 2 plate, 6 ref.

Descriptors: *Sedimentation, *Diagenesis, *Consolidation, *Compaction, *Louisiana, Mississippi River Basin, Density, Porosity, Permeability, Analytical techqniques, Fluorometry, X-ray diffraction, X-ray fluorescence, Spectrophotometry, Nitrogen, Carbonates, Organic matter.
Identifiers: Atchafalaya River Basin (La).

X-ray radiography was utilized extensively in examining core slabs from a fresh-water clay sequence in the Atchafalaya River Basin, Louisiana. From the radiographs, detailed diagenetic features such as cementation by secondary precipitated minerals, pyrite and carbonate replacement of organic fragments, and progressive formation of nodules were revealed. Selected samples were analyzed by means of differential thermal analysis, X-ray diffraction, X-ray fluorescence, atomic absorption spectrophotometry, Kjeldahl method for total nitrogen and wet combustion for organic carbon. The diagenetic mineral accumulations consisted of calcium carbonate, ferric oxide, ferrous carbonate, and Mg and Mn compounds of unknown nature and have contributed significantly to the observed strength increase with depth. The dewatering process, commonly attributed solely to compaction resulting from overburden, may also be brought about by a gradual replacement of the pore-water space by secondary mineral accumulation. (Knapp-USGS)
W69-07385

EXPERIMENTS ON FORMATION OF CONTORTED STRUCTURES IN MUD,
Geological Survey, Denver, Colo.; and Geological Survey of Israel, Jerusalem.
Edwin D. McKee, and Moshe Goldberg.
Geol Soc Amer Bull, Vol 80, No 2, pp 231-243, Feb 1969. 13 p, 8 plate, 2 tab, 41 ref.

Descriptors: *Sedimentary structures, *Mud, *Load distribution, Compaction, Silts, Faults (Geology), Movement, Diagenesis, Deposition (Sediments), Sedimentation, Model studies, Laboratory tests.
Identifiers: Contorted bedding.

Contorted structures can be formed in mud or sand as a result of differential loading. Experiments were conducted in water tanks to test various factors of possible significance in the contortion of mud by loading. The most significant of 6 factors tested was distribution of load, but others affecting the type of structure under certain conditions were the manner of depositing the mud, the form of the underlying surface, the direction of loading, and the movement or lack of movement of water during loading. Organic material was shown to be unnecessary in forming conical structure or convolute bedding. Strength of base had little or no influence on convolute-structure development. Contortions ranged from the simple anticlinal type with vertical axial plane, commonly referred to as convolute, to structures with gently dipping axial planes, to others with lateral extensions or 'flames' from the apexes, and, finally, to those with complex overturned folds. Causes of these variations were determined in terms of the factors listed. Some additional forms of contorted bedding result from other types of penecontemporaneous deformation such as slumping from undermining or from oversteepening, differential lateral movement, and surface drag; these forms differ from those structures formed by loading.
W69-07386

SUBMARINE END MORAINES AND ASSOCIATED DEPOSITS ON THE SCOTIAN SHELF,
Bedford Inst., Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
Lewis H. King.
Geol Soc Amer Bull, Vol 80, No 1, pp 83-96, Jan 1969. 14 p, 7 fig, 2 plate, 15 ref.

Descriptors: *Glacial drift, *Continental shelf, Marine geology, Geomorphology, Aquifers, Sediments, Sedimentation.
Identifiers: *Canada, End moraines, Scotian Shelf.

A submarine end-moraine complex occurs on the Scotian Shelf south and east of Halifax at 30 to 40 km offshore. It extends as a belt of low ridges which lies parallel to the present coast. Some of the larger individual ridges extend up to 55 km in length, with a slight arcuate pattern, and are an average of 50 m in height above the underlying bedrock. The full extent of the system has not been determined; however, a cursory examination indicates its occurence along at least 500 km of the coast, in water depths ranging from 70 to 200 m. The moraine pattern is not revealed on the published bathymetric chart, because the ridges are to a large degree sub-bottom features, masked by ponded clay and silt deposits. However, the extreme peaks of some ridges may crop out slightly above the clay and silt of the bottom, so that their pattern must be resolved by detailed geologic mapping. The materials forming the exposed portions of the ridges range from relatively unaltered to completely reworked glacial debris, depending on the depth of water in which they occur. Resolution of the moraine pattern is greatly enhanced when the ridges are mapped as sub-bottom features, using high-frequency echograms obtained at closely spaced intervals. The degree of penetration with such an echo-sounder is limited essentially to the base of the clay, but the full profile of the moraines above the underlying bedrock is revealed by low-frequency, continuous seismic reflection profiles. Sub-bottom records and textural data on bottom samples indicate the occurrence of stratified proglacial deposits associated with the moraines. (Knapp-USGS)
W69-07393

CLAY MINERALS OF THE COLUMBIA RIVER: A QUALITATIVE, QUANTITATIVE, AND STATISTICAL EVALUATION,
Washington Univ., Seattle. Dept. of Oceanography.
H. J. Knebel, J. C. Kelly, and J. T. Whetten.
J Sediment Petrol, Vol 38, No 2, pp 600-611, June 1968. 12 p, 7 fig, 4 tab, 11 ref. Nonr 477 (37), AT-(45-1)-1725, GP-3591.

Descriptors: *Sedimentology, *Clays, *Columbia River, Mineralogy, Provenance, Weathering, Sediment transport, Statistical methods, Correlation analysis.
Identifiers: Discriminant analysis.

The relative amounts of montmorillonite, illite, and chlorite-kaolinite in the bottom sediments vary

considerably between the reservoirs of the Columbia River. The relative fractions of montmorillonite increase progressively downstream; illite shows an inverse trend; the amounts of chlorite-kaolinite remain consistently low throughout the river. Discriminant function analyses indicate significant differences in 3 areas of the Columbia River based on the variability of clay minerals in 6 groups of samples from reservoirs: Grand Coulee in the upper reaches, Rocky Reach, Wanapum, and Priest Rapids in the min-reaches, and Bonneville, Dalles, McNary, and Ice Harbor in the lower reaches of the river. Samples from tributaries of the lower Columbia River differ significantly from all other groups. The presence and distribution of 2 distinct types of weathering environments within the Columbia River Basin may account for some of the agreement between observed clay mineral fractions and those predicted from source area evaluations, and they may confirm the reliability and sensitivity of the discriminant analysis in distinguishing between 2 groups on the basis of clay mineral variability. The use of the discriminant function analysis in clay mineral studies is potentially valuable for vertical as well as horizontal correlation. (Knapp-USGS)
W69-07409

TIDAL STREAM ACTION AND SEA LEVEL CHANGE AS ONE CAUSE OF VALLEY MEANDERS AND UNDERFIT STREAMS,
Newcastle Univ. (Australia). Dept. of Geography.
For primary bibliographic entry see Field 02L.
W69-07417

TIDAL FLAT SEDIMENTATION ON THE COLORADO RIVER DELTA, NORTHWESTERN GULF OF CALIFORNIA,
Humboldt State Coll., Arcata, Calif.
Robert Wayne Thompson.
Geol Soc Amer Mem 107, 1968. 133 p, 35 fig, 25 plate, 16 tab, 64 ref, 1 append. API Project 51.

Descriptors: *Deltas, *California, *Sedimentation, *Colorado River, Alluvial channels, Currents (Water), Tides, Waves (Water), Winds, Coasts, Flood plains, Sedimentology, Sands, Silts, Tidal marshes.
Identifiers: Baja California (Mex), Tidal flats.

Barren mud and salt flats form a low-lying coastal plain at the northwestern end of the Gulf of California. The region is arid, and characterized by a maximum spring tide range of 8 to 10 m. The sequence of sediment types includes chaotic muds and evaporites, moderate brown, well-laminated clayey silts, brown to gray mottled silty clays, and gray, poorly laminated silty clays and clayey silts. The silts and clays are derived from suspended load of the Colorado River, and are carried to the site of deposition by Gulf tidal currents. The high mud flats developed by depositional regression. Mud supply diminishes toward the south, and wave effects are accentuated accordingly. Coarse sand is carried northward to form prominent longshore spits which finger out into the intertidal muds. Sediment supply has been much reduced for the past 50-60 yr due to diversion of the Colorado River into the Salton Sea and the subsequent construction of Hoover Dam. Consequently, waves have winnowed the poorly segregated mud-flat deposits, piled coarse mollusk remains into beach ridges fringing the northern high flats, and developed a fine sand and shell veneer over the intertidal zone. Older beach ridges, now largely encased by intertidal muds, record an earlier period of low mud supply and reworking which was probably initiated 1000 to 1500 years B.P. by diversion of the Colorado River into the Salton Basin to the north. (Knapp-USGS)
W69-07422

EROSION CONTROL AT HOLLINGER MINE TAILING SITE,
Hollinger Consolidated Gold Mines Ltd., Timmins (Ontario).
I. M. Gordon.
Can Mining J, Vol 90, No 6, pp 46-50, June 1969. 5 p, 5 photo, 1 tab.

Descriptors: *Erosion control, *Planning, *Plant growth, Grasses, Trees, Sludge, Sewage disposal, Cost analysis, Moisture, Seasonal, Slopes, Swamps.
Identifiers: *Canada, Tailings erosion control, Canadian mine-erosion control.

The best method of protection from erosion of the Hollinger Mine tailings was investigated by planting grass and trees (poplar, jackpine, black spruce, etc.) on the slopes and plateau of the tailing deposit of 70 to 90 ft above the original low-lying ground. The article contains the following brief chapters: (1) long-term planning; (2) erosion control of slopes; (3) erosion control of the plateau; (4) description of grasses; (5) method of seeding and seed mixture; (6) method of planting trees and type of nursery stock used; and (7) concluding remarks. The results of the application of grass and tree planting to the tailings deposit can be considered as entirely satisfactory because grasses and trees are growing on the slopes and the 100-ft-high plateau is gradually becoming parkland. (Gabriel-USGS)
W69-07489

DYNAMIC DIVERSION: INFLUENCE OF LONGSHORE CURRENT-TIDAL FLOW INTERACTION ON CHENIER AND BARRIER ISLAND PLAINS,
California Univ., Davis. Dept. of Geology; and California Univ., Bodega Bay, Calif. Bodega Marine Lab.
For primary bibliographic entry see Field 02L.
W69-07525

SEDIMENTARY PROCESSES OPERATIVE ALONG THE WESTERN LOUISIANA SHORELINE,
Continental Oil Co., Ponca City, Okla.
For primary bibliographic entry see Field 02L.
W69-07526

ORGANIC MATTER IN THE GLACIOMARINE SEDIMENTS OF THE EASTERN ANTARCTIC,
Akademiya Nauk SSSR. Institut Geologii i Razrabotki Goryuchikh Iskopaemykh.
O. K. Bordovskiy.
Oceanology of the Academy of Sciences of the USSR, AGU, Washington, D. C., Vol 8, No 1, pp 54-60, 1968. 7 p, 1 fig, 3 tab, 13 ref.

Descriptors: *Antarctic, *Glacial drift, *Glaciers, *Sediment transport, *Organic matter, Sands, Clays, Bituminous material, Humus, Icebergs, Benthic fauna, Biomass, Nitrogen, Oxygen.
Identifiers: Eastern Antarctic, Glaciomarine Antarctic sediments.

Distribution and composition of organic matter in the recent glaciomarine Antarctic sediments is analyzed on the basis of the analysis of samples collected by the first Soviet Antarctic expedition on the Motor Vessel Ob; and using earlier publications. The study shows that the organic matter of glaciomarine sediments of eastern Antarctic is typified by a number of features also found in the organic matter of other marine sediments. Some specific features affecting the Antarctic bitumens are apparently due to the nature of sedimentation, namely the dominant role of benthic filter-feeding organisms in the sedimentation of organic matter. (Gabriel-USGS)
W69-07528

NATURAL AND MAN-MADE EROSION IN THE HUMID TROPICS OF AUSTRALIA, MALAYSIA AND SINGAPORE,
Hull Univ. (England). Dept. of Geography.
Ian Douglas.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 17-30, 1967. 14 p, 6 fig, 6 ref.

Descriptors: *Erosion, *Tropical regions, *Rain forests, Humid climates, Weathering, Residual soils, Accelerated erosion, Floods, Sediment yield, Hydrogeology.
Identifiers: *Australia, *Malaysia, *Singapore.

Under natural rain forest conditions in the humid tropics there is a striking contrast between the great depth of weathered rock material and soil, often exceeding 30 m, and the very small concentrations of suspended and dissolved matter carried in stream waters. The dense forest vegetation which exists in a delicate ecological balance with the soil, exerts a protective effect against mechanical processes such as raindrop splash and slope wash, but favors the chemical attack on minerals. Variations in the nature of the vegetation cover affect the rate of erosion under natural conditions. Once the vegetation is removed the rate of erosion is greatly increased. Comparisons between rates of erosion determined on headwater streams, where interference is minimal, and at stations further downstream, where considerable human activity affects river behavior, are used to illustrate the effects of forestry, grazing, tree crops, cultivation, mining, and urban development. A great volume of erosion occurs during the construction stage when large areas of soil are left exposed to the effects of splash and surface runoff. These conditions provide very rapid rates of runoff to streams, producing much higher flood peaks than occur natural under conditions with consequent damage to stream banks and riverine structures. More permanent are the effects of changes in land use of river regimes and on the course of erosion. With increasing human occupance of the catchment areas of the humid tropics, erosion becomes concentrated into short duration flood events which may cause disruption to river users and flood plain dwellers in the lower parts of the catchment areas. (Knapp-USGS)
W69-07539

EROSION OF GRANITE TERRAINS UNDER TROPICAL RAIN FOREST IN AUSTRALIA, MALAYSIA AND SINGAPORE,
Hull Univ. (England). Dept. of Geography.
Ian Douglas.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 31-40, 1967. 10 p, 1 tab, 8 ref.

Descriptors: *Erosion, *Weathering, *Tropical regions, Rain forests, Humid climates, Residual soils, Sediment yield, Hydrogeology, Water quality, Water chemistry.
Identifiers: *Australia, *Malaysia, *Singapore.

Observations of streams draining tropical rain forest covered granite catchments in Singapore, West Malaysia, and Northeast Queensland, Australia reveal that while dissolved solids concentrations and suspended sediment concentrations are always low (usually less than 50 ppm and 100 mg/l respectively) the total loads carried by streams under natural, undisturbed conditions may be fairly high, up to 100 cu m/sq km/yr when the mean annual rainfall is around 4,000 mm. Despite the common assertion that the humid tropical environment favors chemical weathering, more of the total load evacuated from the catchments studied is carried as suspended matter than in solution, because of the supply of fine colloidal clay particles to the streams by subsurface movement of drainage water in the soil profile and by the undercutting of stream banks. Small streams containing a lot of organic matter, and probably deriving most of their flow from groundwater and soil water have a pH between 5.7 and 6.4, whereas those flowing more rapidly with sandy or boulder beds have a pH between 6.5 and 7.5. Silica is the main dissolved constituent, concentrations varying from 6 to 32 ppm, depending on discharge and on the degree of incision of the stream channel into the deep mantle of weathered rock. The more readily soluble materials such as calcium and magnesium form a higher proportion of the dissolved content of drainage waters than of the rock from which they

are derived, demonstrating their preferential removal from the granite. (Knapp-USGS)
W69-07540

BED LOAD TRANSPORT AT FLOOD TIME,
Szkola Glowna Gospodarstwa Wiejskiego, Warsaw (Poland). Dept. of Hydraulics Engineering.
J. Skibinski.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 41-47, 1967. 7 p, 4 fig, 8 ref.

Descriptors: *Sediment transport, *Bed load, *Floods, Streams, Non-uniform flow, Hydraulic models, Flumes, Sedimentation rates, Sediment discharge, Sedimentology.
Identifiers: Flood wave, Bed load transport.

With the same flow volume, the intensity of bed load transport is greater in the rising phase of the flood wave than in the falling phase. This affects bed load calculations for floods and total bed load tranport. Tests were made in a flume 23 m long and 0.60 m wide, with a sand bed 0.25 m deep. The sand-grain representative diameter was 0.414 mm. Water flow varied between 0.009 to 0.120 cu m/sec. Mean velocities were from 0.088 to 0.795 m/sec with water depths from 0.05 to 0.40 m. Tests were run with rising wave to falling wave ratios of 1:1.93 and with constant water depths of 0.10 to 0.40 m. Formulae were derived relating bed load transport to velocity and water depth. Results of tests are shown grapically. (Knapp-USGS)
W69-07541

EFFECT OF RECENT CRUSTAL MOVEMENTS ON THE SHAPE OF LONGITUDINAL PROFILES AND WATER LEVELS IN RIVERS,
Akademiya Nauk URSR, Kiev. Instytut Geologichnykh Nauk.
N. G. Volkov, I. L. Sokolovsky, and A. I. Subbotin.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 105-116, 1967. 12 p, 5 fig.

Descriptors: *Erosion, *Degradation (Stream), *Land subsidence, Geomorphology, Structural geology, Terrain analysis, Profiles, Water levels.
Identifiers: Tectonic movements, Geologic uplift.

Breaks in the longitudinal profiles of streams may be caused by tectonic movements as well as by the influence of tributaries or the composition of the rocks the river is eroding. To calculate the effects of tectonic movements, a theoretical profile of the river shape may be calculated and compared with the actual shape. With a long enough record, changes in stage at constant discharge give a measure of degradation or aggradation caused by uplift or subsidence. An analysis of discharge data from over 130 gaging stations in the USSR shows that crustal movement calculated by degradation rate compares with the rate of recent crustal movements obtained by surveying methods. (Knapp-USGS)
W69-07543

THE PATTERN OF SEDIMENT MOVEMENT IN THE RIVER TYNE,
Department of Water Resources (England). Devon River Authority.
For primary bibliographic entry see Field 02L.
W69-07544

COARSE BEDLOAD AS A FACTOR DETERMINING BED SLOPE,
David N. Wilcock.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 143-150, 1967. 8 p, 3 fig, 1 tab, 7 ref.

Descriptors: *Sediment transport, *Bed load, *River beds, *Channel morphology, *Particle size, Hydraulic gradient, Velocity, Discharge (Water), Turbulence, Hydraulics, Regime, Streamflow.
Identifiers: River bed morphology, River bed slopes.

Field tracer studies were undertaken to assess the part played by coarse bedload in determining the characteristics of bed slope at 21 sampling stations within the upper 20 sq mi of the upper Hodder catchment, Northeast Lancashire, England. Bedload sampling was based on linear transects of the stream, and description of the size characteristics upon the log normal distribution. Bed slope was surveyed at every reach by quickest level after the passage of a bankfull flood, and this slope was designated as the 'normal' slope of the reach under present discharge/sediment conditions. Statistical tests of slope/geometric mean particle size relationships were made. Lithology was seen to exert little effect on any relationship, and Hack's 1957 formula was confirmed as the one of most general applicability. Competence tests on 1,000 tracer pebbles allowed the calculation of critical shear stress for different size categories, from which it was possible to calculate for each of the 21 stations the bankfull competence, and residual bedload at each station. Bed slope was found to correlate logarithmically with the median of this residual bedload fraction, (r) exceeding 0.9. Implications of the work involve the concept of bed slope as either a relic feature, or as a function of bedload possibly supplied under present-day conditions but subject to diminuation only in situ. The attraction of such a relationship is that it introduces a dynamic aspect into the problem of bed slope, as opposed to the rather static explanations previously invoked. Some channel shape control is also implied. (Knapp-USGS)
W69-07545

DISCHARGE FREQUENCY COMPARED TO LONG-TERM SEDIMENT YIELDS,
Agricultural Research Service, Sidney, Mont. Northern Plains Soil and Water Research Center.
For primary bibliographic entry see Field 04D.
W69-07548

THE EFFECT OF MORPHOLOGICAL PROCESSES IN ALLUVIAL CHANNELS ON FLOW CONDITIONS,
Hydraulic Research Inst., Prague (Czechoslovakia).
Jaroslav Martinee.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 243-249, 1967. 7 p, 5 fig, 1 tab, 4 ref.

Descriptors: *Bed load, *Sediment yield, *Channel Morphology, *Stage-discharge relations, Regime, Sediment load, Alluvial channels, Channel flow, Sands, Sediment transport, Roughness (Hydraulic), Discharge measurement.
Identifiers: Streambed morphology, Rating curves.

The continuously changing sandy bed in alluvial channels has a substantial influence on flow conditions. A series of experimental measurements was carried out in a representative river reach in order to study the effect of ripples and sand transport on flow resistance. The shape of river bed forms was measured in a broad range of discharges and the traveling velocity of sand ripples calculated to estimate the total volume of sediment transport. The correct stage-discharge relation gradually deviates from values which would be calculated for the basic river bed roughness. This difference can be as high as 50% of the expected value. The height of ripples increases with the growing discharge. In a representative river reach it corresponded roughly to one-fifth of the respective water depth and similar ratios have been observed at other sites. A substantial increase of flow resistance is caused by the effect of sand ripples and sand transport, reducing the channel capacity to one-half of the value predicted only by the grain size of the bed material. A considerable shifting of discharge rating curves must be expected, and is shown by comparison of measurements in the representative river reach over an 11 year period. (Knapp-USGS)
W69-07549

2K. Chemical Processes

ON THE OCCURRENCE OF NATURAL HYDROCARBONS IN WATERS (GERMAN),
Coblentz Federal Hydrologic Labs. (West Germany).
Hubert Hellman, and Franz-Josef Bruns.
Deut Gewasserkundliche Mitt, 13 Jahrgang, Heft 2, pp 54-60, Apr 1969. 7 p, 8 fig, 1 tab, 13 ref.

Descriptors: *Oily water, *Water chemistry, *Ponds, Analysis, Surface waters, Suspended load, Plankton, Sediments, Methane, Plants, Soils, Oily water, River beds, Algae, River flow.
Identifiers: *Germany, Rhine River, Hydrocarbon occurrence in water.

The occurrence of hydrocarbons in the surface waters and sediments of rivers and ponds was investigated on the basis of spectral and chemical analyses of water samples of the Rhine River at Koblenz, Germany, and several ponds. The study shows that a considerable amount of organic matter is often present in the sediments and waters of rivers, lakes and ponds. (Gabriel-USGS)
W69-07369

PRINCIPLES AND APPLICATIONS IN AQUATIC MICROBIOLOGY,
Rutgers - The State Univ., New Brunswick, N. J. Dept. of Environmental Sciences.

H. Heukelekian and Norman C. Dondero, (Editors). Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. John Wiley and Sons, Inc, New York, 1963. 452 p.

Descriptors: *Aquatic microbiology, *Conferences, Actinomycetes, Aquatic bacteria, Aquatic microorganisms, Coliforms, Euteric bacteria, Iron bacteria, Marine microorgamisms, Methane bacteria, Photosynthetic bacteria, Photosynthesis, Sphaerotilus, Pesticides, Phosphorus compounds, Lakes, Ponds, Self-purification, Rivers, Interfaces, Pigments, Fermentation, Methane, Infiltration, Sulfur compounds.
Identifiers: Alkanes, Hydrocarbons, Manganese bacteria, Leptothrix, Arthrobacter, Chemical transformation, Rumen bacteria, Rumen protozoa, Proteolysis, Research planning.

This volume comprises the proceedings of the third Rudolfs Research Conference held in 1963 at Rutgers University. 'Aquatic microbiology' is used here in its broadest sense and embraces phenomena in lakes, reservoirs, streams, estuaries, oceans, or sewage treatment processes. Arrangers of the conference attempted to cross disciplinary lines because techniques and insights from peripheral areas can contribute to knowledge of aquatic microbiology. Editors state that differences in the diverse environments considered are merely quantitative with respect to organic and inorganic nutrients. Their objective was to make meaningful the organisms and their activities in these environments. The publication includes individual contributions on the following topics, which will be abstracted separately: effect of hydrocarbon structure on bacterial alkane utilization; microbiology of pesticides and related hydrocarbons; microbial transformation of minerals; role of phosphorus in microbial ecology; iron and manganese bacteria; Sphaerotilus-Leptothrix organisms; deterioration of organic materials by marne organisms; lake and pond bacteria; river bacteriology and self-purification; interfacial bacteriology; coliform physiology; actinomycetes; Arthrobacter; ecology and physiology of photosynthetic bacteria; protists, pigments, and photo-synthesis; methane fermentation; transformations in infiltration ponds; rumen bacteriology; physiology of rumen protozoa; microbial transformation of organic sulfur; proteolytic organisms; and trends and needs in research. See also W69-07424 thru W69-07435 (Eichhorn-Wisc)
W69-07423

ECOLOGY AND PHYSIOLOGY OF THE PHOTOSYNTHETIC BACTERIA,
Pennsylvania State Univ., University Park. Dept. of Microbiology.
E. S. Lindstrom.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 280-297, 1964. 6 fig, 3 tab, 20 ref, disc.

Descriptors: *Photosynthetic bacteria, *Photosynthesis, *Ecology, *Aquatic microbiology, Molecular structure, Carbon, Sulfur compounds, Aerobic bacteria, Anaerobic bacteria, Domestic wastes, Industrial wastes, Oxidation, Metabolism, Ammonia, Nitrogen fixation, Amino acids, Phototropism, Pigments, Mud, Ponds, Streams, Absorption, Chlorophyll, Wisconsin, Pennsylvania.
Identifiers: *Taxonomy, *Physiology, *Photometabolism, Conversions, Heterotrophs, Molecules, Assimilation, Pseudomonadales, Athiorhodaceae, Thiorhodaceae, Chlorobacteriaceae, Rhodospirillum rubrum, Lake Mendota (Wis), Chromatophores, Carotenoids, Fixation, Cytochromes, Quinones.

Photosynthetic bacteria are classified according to pigment, usual electron donor, respiratory metabolism, and growth factor requirements. Features in common are: polar flagella, possession of dehydrative type of glucose splitting, and photosynthetic metabolism similar to photosynthesis of green plants. Morphologically and physiologically grouped with Pseudomonas, they occur in muds in freshwater and marine environments under light and anaerobic conditions. Major importance is their use in the study of photosynthesis rather than as metabolizers of problem molecules from domestic or industrial waste. Their photometabolism results in assimilation, especially of low-molecular-weight carbon- and sulfur-containing molecules. Bacteria cannot carry out rapid conversions and would be overgrown by aggressive heterotrophs. If attractive to some protozoan or other grazing fauna, they might be significant in sanitary microbiology. The nutrients they assimilate form solely new cellular material. In light, they reverse the effect of the majority of microorganisms which specialize in decomposition and assimilate carbohydrates completely. Significant is their mechanism, localized in the cell membranes, for getting energy from light with the chlorophyll, carotenoids, cytochromes, quinones, as do the higher plants. They all metabolize gases, carbon, hydrogen, and nitrogen in the light, and some metabolize oxygen in the dark. For main entry see W69-07423. (Jones-Wisc)
W69-07430

DETERIORATION OF ORGANIC MATERIALS BY MARINE ORGANISMS,
Bell Telephone Labs., Inc., Murray Hill, N. J.
Waldimero Coscarelli.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 113-147, 1964. 11 fig, 15 tab, 16 ref, disc.

Descriptors: *Marine microorganisms, *Aerobic, *Anaerobic, *Bacteria, *Deterioration, *Organic matter, *Sea water, *Mollusks, *Crustaceans, Plastics, Elastomers, Resins, Rocks, Insulation, Clams, Isopods, Carbon, Nitrogen, Phosphorus, Depth, Temperature, Pressure, Conductors, Castings, Rubber, Fibers (Plant), Sediments, Fouling, Fungi, Carbohydrates, Sulfides.
Identifiers: Bell System, Cables, Wood, Jute, Hemp, Malayan gum, Laminates, Borers, Shell, Teredo, Bankia, Limnoria, Gutta percha, Gulf of Corinth, Pholodidae, Gribble, New Zealand, Holyhead, Dublin, Adriatic Sea, William F Clapp Laboratories, Duxbury (Mass), Wrightsville Beach (NC), Daytona Beach (Fla), Fibers (Synthetic), Coal products.

To determine resistance of synthetic materials in marine environments, marine borers were studied under natural exposure conditions and bacteria under laboratory conditions. In marine situations, over seventy materials (600 individual specimens) were exposed. Deterioration was confined primarily to attack by marine borers. Most plastic materials resisted borers and microorganisms, except the poly (vinyl chlorides) and polymides, half of which types were penetrated by pholads. Rubber samples showed evidences of borer penetrations and surface cracking. Polymide fibers apparently resist borers and microorganisms better than treated natural fibers. Polyethylene has shown negligible deterioration both in laboratory and ocean exposures. Castings resins resisted bacterial attack but were penetrated by pholads. Susceptibility of elastomers in laboratory studies indicates that bacteria may be implicated in the surface cracking phenomenon, appearing on ocean exposure specimens after seven years. Synthetic cellulosic fibers are degraded in ocean environment by borers and microorganisms, and preliminary laboratory studies indicate some susceptibility to bacteria. Although gross observations of poly (vinyl chlorides) subjected to ocean environments reveal no signs of microbial activity, laboratory studies provide ample evidence that these materials, depending upon formulation, can be utilized by bacteria under certain optimum conditions. For main entry see W69-07423. (Jones-Wisc)
W69-07433

IRON AND MANGANESE BACTERIA,
Illinois Univ., Urbana. dept. of Microbiology.
R. S. Wolfe.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 82-97, 1964. 13 fig, 1 tab, 24 ref.

Descriptors: *Bacteria, *Iron, *Manganese, Oxidation, Water works, Electron microscopy, Springs, Seepage, Nutrient requirements, Pollutants, Iron oxides, Physiological ecology, Acidity, Acid mine water, Enzymes, Electrochemistry, Biochemistry, Metabolism, Estuarine environment.
Identifiers: Gallionella, Ferrous ions, Ferric hydroxide, Flagella, Micrographs, Leptothrix ochracea, Leptothrix major, Leptothrix discophora, Leptothrix trichogenes, Sphaerotilus natans form eutrophica, Chlamydothrix sideropus, Leptothrix sideropus, Clonothrix fusca, Thiobacillus ferrooxidans, Ferrobacillus ferrooxidans, Ferrobacillus sulfooxidans, Crenothrix polyspora, Taxonomy, Chlamydobacteria, Manganese oxide, Autothrophy, Morphology, Adenosine triphosphate.

Species of iron and manganese bacteria are separated taxonomically by biochemical behavior, especially ability to oxidize iron and manganese, and by cell depositions and structures. Iron bacteria are gradient organisms, establishing themselves at a propitious point between the source of ferrous ions and the air, and are found especially in estuarine environments, natural iron springs, seepages, and acid mine drainage. Studied with the electron microscope, the twisted stalks, composed of strands of ferric hydroxide, and flagella are found in Gallionella. The sheath-forming iron bacteria, like hollow iron pipes with ferric hydroxide, are controversial. The diversities of form may depend upon nutrients, thus sheaths may not be found in yeast extract-tryptone medium. Slime formation was observed in a medium containing 0.5 percent peptone. Some have empty sheaths and no cells; others, long filaments and large cells; or short brittle sheaths, mostly empty. Crenothrix polyspora has round non-motile, conidia-like cells derived from rod shaped cells. Two essentials for autotrophic existence to be explained are: adenosine triphosphate must be obtained for driving synthetic reactions, and the organism must obtain reducing potential for the reduction of carbon dioxide to the carbohydrate level. The enzymic steps in iron oxidation remain to be demonstrated. For main entry see W69-07423. (Jones-Wisc)
W69-07434

AMORPHOUS CLAY FRACTION OF SOILS AND ITS ADSORPTIVE PROPERTIES. A SELECTED BIBILOGRAPHY,
Wisconsin Univ., Madison. Dept. of Soil Science.
D. A. Graetz.
Scientific Information Program in Eutrophication, Wisconsin Univ, Madison, Document No 308064, 11 pp, Feb 1969. 140 ref.

Descriptors: *Adsorption, *Clays, *Soils, Chemical analysis, Insecticides, Sediments, Soil chemistry.
Identifiers: Chemical composition.

This bibliography contains 140 references relating to the noncrystalline clay fraction of soils and sediments, and should be of value to anyone working on their characterization. The difficulty in isolation of these materials has meant that they have been largely overlooked although, in many sediments, they may comprise a sizeable portion of the total. Also included are some references bearing on adsorptive properties of these amorphous minerals, particularly as regards insecticide adsorption. (Konrad-Wisc)
W69-07436

AN INVESTIGATION OF THE INTERRELATIONSHIP OF ORGANIC MATTER AND TRACE ELEMENTS IN FRESH WATER,
Rhode Island Univ., Kingston. Water Resources Center.
James T. Corless.
Completion Report OWRR Project A-013-RI, 1968. 25 p.

Descriptors: *Trace elements, *Organic matter, *Copper, *Water analysis, *Ponds, *Brackish water.
Identifiers: *Organo-metallic compounds, *Anoxic zone.

The distribution of copper in an unpolluted natural water system was investigated. Samples were taken from a fresh water pond and its downstream brackish water extension, containing an underlying saline, anoxic (H_2S detectable) basin. Neutron activation analysis was used to determine total copper, organic copper, and copper extractable with organic solvents. This was done for the particulate, colloidal and dissolved ranges of the water samples. Copper concentrations were variable in the pond and brackish river waters during the study period. A hypothesis was developed to relate some of the changes in the pond's copper concentrations to fluctuations in rainfall. Variations in copper distribution between the three different particle size ranges and their organic content were observed. Most of the copper detected in the anoxic zone appeared to be associated with particulate organic material that had precipitated out of the overlying waters. Organic solvents yielded evidence of three different organo-copper compounds existing in the three environments sampled. (Thompson-Rhode Island Univ0
W69-07470

DEVELOPMENT OF METHODS FOR CONTROLLING THE COPPER CONTENT IN WATER,
Rhode Island Univ., Kingston. Water Resources Center.
For primary bibliographic entry see Field 05F.
W69-07471

POND ECOLOGY AND WATERFOWL PRODUCTION IN RELATION TO OPTIMUM WATER RESOURCES UTILIZATION IN THE TURTLE MOUNTAINS OF NORTH DAKOTA,
North Dakota State Univ., Fargo. Dept. of Zoology.
For primary bibliographic entry see Field 06G.
W69-07475

BIOCHEMICAL RELATIONSHIPS AND INORGANIC NITROGEN EQUILIBRIUM IN SEMI-ENCLOSED BASINS,
Swedish Occanographic Inst., Goteborg.

R. Sen Gupta.
Tellus, Vol 21, No 2, pp 270-281, 1969. 12 p, 5 fig, 3 tab, 13 ref.

Descriptors: *Pollutants, *Biochemistry, *Nitrogen, *Lake basins, Oxidation, Lagoons, Anaerobic bacteria, Nitrates, Sulfates, Equilibrium, Hydrogen, Phosphates, Hydrologic data, Fjords, Statistical methods, Life cycles.
Identifiers: Semi-enclosed basin biochemistry.

A state of equilibrium of the inorganic nitrogen compounds in anoxic basins was investigated on the basis of concentration measurements of nitrate-, nitrite-, and ammonia-nitrogen using the pE parameter. The study shows that in narrow basins and under oxidation conditions the system nitrite-nitrate is found to approach certain equilibrium values. From the proximity of the calculated values to the equilibrium values the system nitrate-nitrite-ammonium appears to exist at least in partial equilibrium in marine environments independent of the general equilibrium condition controlled by the system hydrogen-hydrogen-ion-water. (Gabriel-USGS)
W69-07504

SOLUBILITY OF ALUMINUM IN THE PRESENCE OF HYDROXIDE, FLUORIDE, AND SULFATE,
Geological Survey, Washington, D. C.
C. E. Roberson, and J. D. Hem.
Geol Surv Water-Supply Pap 1827-C, 1969. 37 p, 18 fig, 5 tab, 19 ref.

Descriptors: *Water chemistry, *Aqueous solutions, *Solutes, *Solu bility, Aluminum, Fluorides, Sulfates, Ions, Temperature, Pressure, Free energy, Thermodynamics, Mineralogy.
Identifiers: Aluminum hydroxides.

The total concentration of aqueous dissolved species of aluminum that will be present in equilibrium with microcrystalline gibbsite at various levels of complexing ligand concentration are shown graphically. The graphs can be used to estimate aluminum solubility, at 25 deg C and 1 atmosphere total pressure, when the pH of the solution, its ionic strength, and the total sulfate and fluoride concentrations are known. The standard free energy of formation of cryolite calculated from solubility experiments is -745.4+ or minus 1.0 kcal per mole at 25 deg C. Diagrams are included showing the solubility of cryolite in terms of aluminum, fluoride, and sodium concentrations. The stability fields of cryolite and microcrystalline gibbsite and their solubilities also are shown on pH- (F) diagrams. (Knapp-USGS)
W69-07515

CHEMICAL EQUILIBRIUM BETWEEN GYPSUM AND BRACKISH AND SLIGHTLY SALINE WATERS AT LOW TEMPERATURE AND PRESSURES,
Bordeaux Univ. (France). Hydrogeological Centre.
J. A. Cherry.
Chem Geol, Vol 3, No 4, pp 239-247, Dec 1868. 9 p, 3 fig, 5 tab, 20 ref.

Descriptors: *Water chemistry, *Gypsym, *Equilibrium, Chemical potential, Sulfates, Ionization, Solubility, Aqueous solutions, Solutes, Saturation, SOLVATION.
Identifiers: Ionic activity coefficients.

The solubility product of gypsum was calculated from free energy of reaction and used to evaluate the procedure of Garrels and Thompson for calculating ionic species in natural waters of brackish to slightly saline composition. It was found that cumulative errors in the method are appreciable. With routine water analyses and our present knowledge of dissociation constants and activity coefficients, we must allow a broad interval of possible saturation values. (Knapp-USGS)
W69-07518

PREVENTION OF ADSORPTION OF TRACE AMOUNTS OF GOLD BY CONTAINERS,
Geological Survey, Denver, Colo.
T. T. Chao, E. A. Jenne, and L. M. Heppting.
Geol Surv Res 1968, Prof Pap 600-D, pp D16-D19, 1968. 4 p, 4 fig, 4 ref.

Descriptors: *Sampling, *Water analysis, *Adsorption, *Trace elements, *Gold, Aqueous solutions, Treatment.
Identifiers: Sample preservation.

Loss of significant parts of trace amounts of gold by adsorption on container walls, during sample transport and storage, poses a major problem in quantitative determinations of gold in natural water. Experiments using gold-198 as a tracer indicate that gold may be kept in solution for 21 days by (1) acidification of a test solution to pH 1 with hydrochloric acid to and addition of between 5 to 50 mg/1 of bromine, (2) acidification with hydrochloric acid to 1N without bromine, and (3) acidification with nitric acid to 2N or 3N. After 21 days, radioactive decay reduces gamma radiation of gold-198 beyond the limits of accuracy of available equipment and no information was obtained. Addition of 50 mg/1 of bromine to a nonacidified test solution of pH 6 is almost as effective. In contrast to nonacidification, moderate acidification of the test solution to pH 2 or 3 with hydrochloric and acetic acids, as well as acidification to pH 1 with nitric acid, enhances gold adsorption. The pH 1 hydrochloric acid and 50 mg/1 bromine combination is as effective in desorbing gold from container walls as it is in preventing gold adsorption. (Knapp-USGS)
W69-07531

ADSORPTION OF TRACES OF SILVER ON SAMPLE CONTAINERS,
Geological Survey, Denver, Colo.
T. T. Chao, E. A. Jenne, and L. M. Heppting.
Geol Surv Res 1968, Prof Pap 600-D, pp D13-D15, 1968. 3 p, 2 fig, 12 ref.

Descriptors: *Sampling, *Water chemistry, *Adsorption, *Trace elements, Water analysis, Aqueous solutions.
Identifiers: Sample preservation, Silver.

Special care is required to prevent container adsorption of significant parts of the trace amount of silver present in most natural waters. The use of strong acids appears to be the most effective means of retaining the silver in solution. Lowering the pH of the water samples to 1 with either hydrochloric or nitric acid reduced adsorption onto polyethylene containers to approximately 1% of the silver present. Silver adsorption after 30 days of contact time amounted to 4 and 10% of the silver present at pH 2 when adjusted with hydrochloric acid and nitric acid, respectively. Adjustment of the pH to 1 with either hydrochloric or nitric acid was effective in desorbing silver from polyethylene containers in the course of several days. (Knapp-USGS)
W69-07532

2L. Estuaries

TIDAL WAVE CALCULATIONS FOR VARIOUS RIVER REGULATION STAGES DEMONSTRATED BY EXAMPLE OF THE LOWER WESER AND THE LOWER HUNTE RIVERS (German),
Paul Strohmer.
Deut Gewasserkundliche Mitt, 13 Jahrgang, Heft 2, pp 48-54, Apr 1969. 7 p, 8 fig, 1 tab, 15 ref.

Descriptors: *Rivers, *Tidal waters, *Mathematical studies, Flow resistance, Sun, Moon, Dynamics, Topography, Surveys, River beds, Discharge coefficients, Velocity, Estuary, Water level fluctuations.

Tide-wave phenomena were investigated analytically and experimentally using the hydrologic and topographical data recorded along the lower reaches of the Weser and Hunte rivers of Western Germany. The study shows that reliable calculation of tide-wave parameters requires a sufficiently accurate estimate of flow resistance phenomenon. This accurate estimate, however, is based on a careful analysis of known regulation stages. (Gabriel-USGS)
W69-07368

LANDWARD TRANSPORT OF BOTTOM SEDIMENTS IN ESTUARIES OF THE ATLANTIC COASTAL PLAIN,
Geological Survey, Woods Hole, Mass.
Robert H. Meade.
J Sediment Petrol, Vol 39, No 1, pp 222-234, Mar 1969. 13 p, 9 fig, 1 tab, 65 ref.

Descriptors: *Sedimentation, *Estuaries, *Atlantic Coastal Plain, *Sediment transport, Currents (Water), Tidal effects, Tides, Bed load, Sands, Aggradation, Movement, Provenance, Sediment distribution, Aquatic drift, Deposition (Sediments).
Identifiers: Tidal currents.

The estuaries of the Atlantic Coastal Plain are being filled with sediment. River-borne sediment is partially trapped in the estuaries by the predominantly landward flow of estuarine bottom waters. The main evidence of this is measurements of the sediment flux (suspended-sediment concentration and water velocity measured at intervals of depth and through tidal cycles) that show sediment being moved progressively landward along the bottom. Comparisons of the loci of sediment deposition and the patterns of water circulation show that sediment accumulates in estuaries near the upstream limit of landward bottom flow. The movement of sands into the mouths of the larger estuaries from the continental shelf and nearby beaches is also suggested by several other lines of evidence. Bottom waters of the continental shelf move progressively into the mouths of estuaries, and they presumably carry bottom sediments with them. Beach sands move toward and into the mouths of some estuaries at rates of several hundred thousand cubic meters per year. Distinctive mineral components in the lower reaches of estuaries suggest that the bottom sediments were derived from offshore. The rates of filling of the estuaries are different in the northern and southern parts of the Coastal Plain. The large northern rivers carry disproportionately small loads of sediment that have not yet filled the deep valleys which were cut during the ice ages. The southern rivers carry larger sediment loads relative to the sizes of their valleys, and consequently their estuaries are mostly filled with sediment.
W69-07380

ORGANIC PRODUCTION IN A TROPICAL ESTUARY,
National Inst. of Oceanography, Cochin (India). Biological Oceanographic Div.
For primary bibliographic entry see Field 05B.
W69-07388

NEW DEVELOPMENTS IN THE FIELD OF TIDAL HYDRAULICS,
Army Coastal Engineering Research Center, Washington, D. C.
Joseph M. Caldwell.
ASCE Proc, J Hydraul Div, Vol 95, No HYI, Pap 6339, pp 1-8, Jan 1969. 8 p, 14 ref.

Descriptors: *Estuaries, *Tides, *Currents (Water), *Reviews, Hydraulics, Saline water intrusion, Tidal effects, Water level fluctuations, Channel flow, Bibliographies.
Identifiers: Tidal hydraulics, Tidal currents.

The recent advances in tidal hydraulics and the methods of solving tidal hydraulics problems are reviewed. The problems of inlets, canals, and estuaries (including salt water intrusion) are considered and the bibliography gives a selection of the more recent literature on these subjects. The role of the hydraulic model and the computer is described.

The stability of inlets is related to tidal range and inlet cross section. No attempt to develop the procedures for solving tidal hydraulics problems is made; the recent, meaningful advances in this area of engineering are discussed and the literature where more detailed descriptions can be found is reviewed.
W69-07396

TIDAL STREAM ACTION AND SEA LEVEL CHANGE AS ONE CAUSE OF VALLEY MEANDERS AND UNDERFIT STREAMS,
Newcastle Univ. (Australia). Dept. of Geography.
W. F. Geyl.
Australian Geogr Stud, Vol 6, pp 24-42, 1968. 19 p, 7 fig, 1 tab, 32 ref.

Descriptors: *Streams, *Valleys, *River basins, *Meanders, Stream erosion, Streambeds, Streamflow, Tides, Sea level, Estuaries.
Identifiers: *Underfit streams, Sea level changes.

Sea level change is proposed as a cause of underfit streams for coastal plain streams as well as for many cases of underfitness that cannot be explained by climatic change. Lowering of relative sea level has caused the replacement of large-discharge tidal streams by small-discharge ordinary rivers, the one-time tidal channels thus becoming valleys, or valley bottoms, now modified in varying degree by sub-aerial processes since emergence. Some cartographic and morphometric evidence in support of this tidal hypothesis is presented. Underfitness would appear to occur in equatorial regions as well as in the climate zones to which Dury would limit the phenomenon. Topographic maps of Tanganyika, Ghana, Nigeria and elsewhere give the impressinon that valley meanders are to be found there. This is to be expected on the tidal hypothesis, as sea level changes would have affected all coasts. Much more research, and field work in particular, will have to be done before this tidal hypothesis can be firmly established. That climate change has occurred and has affected river discharges and fluvial landforms is not denied. But that sea level changes have occurred is equally certain. A general theory of underfit streams based only on climate change does not seem satisfactory. (Knapp-USGS)
W69-07417

TIDAL FLAT SEDIMENTATION ON THE COLORADO RIVER DELTA, NORTHWESTERN GULF OF CALIFORNIA,
Humboldt State Coll., Arcata, Calif.
For primary bibliographic entry see Field 02J.
W69-07422

WATER RESOURCES DEVELOPMENT OF MULLICA RIVER BASIN, NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
For primary bibliographic entry see Field 06B.
W69-07456

HYDROLOGY OF NEOGENE DEPOSITS IN THE NORTHERN GULF OF MEXICO BASIN,
Louisiana State Univ., Baton Rouge.
Paul H. Jones.
Bulletin GT-2, Apr 1969, La Water Resources Research Inst. 105 pp, 36 fig, 4 tab, 93 ref, 4 app.

Descriptors: Hydrogeology, *Aquifers, *Pore pressure, Permeability, Clay minerals, *Diagenesis, Membrane processes, *Osmosis, Ion exchange, *Thermal water, Connate water, *Salinity, Sedimentation, Dehydration, Water of crystallization, Gulf of Mexico, Gulf Coastal Plain, Heat flow.
Identifiers: Neogene deposits, Geothermal gradient.

The Neogene deltaic and neritic marine deposits in the northern Gulf of Mexico Basin form regional aquifer systems in which pore pressures, salinities, and temperatures do not compare with those in older sedimentary basins. Rapidly buried sand and clay sequences, sealed off by growth faults, remain undercompacted and contain abnormally high fluid pressures (up to 0.96 times the overburden pressure). Such high pressures force saline formation water toward normally-pressured aquifers. The intervening clay beds act like membrane filters to freshen the water, which subsequently dilutes the receiving aquifers. High pressures and trapped radiogenic heat cause diagenesis of montmorillonite to illite. The released fresh water of crystallization either remains in the transformed clay under high pressure, because the adjacent sand beds are already geopressured, or flows to and dilutes normally-pressured aquifers. Osmotic pressures, which are generated by the membrane-like clays and which may be responsible for halting or even reversing these flows, are considered the dominant factor in the preservation of abnormal high pressures. Salinities vary from a few hundred to 300,000 mg/l at any depth below 6,000 feet. Generally decreasing salinities are evident below 12,000 feet. (Hill-Louisiana State Univ)
W69-07467

BIOCHEMICAL RELATIONSHIPS AND INORGANIC NITROGEN EQUILIBRIUM IN SEMI-ENCLOSED BASINS,
Swedish Oceanographic Inst., Goteborg.
For primary bibliographic entry see Field 02K.
W69-07504

FACTORS INITIATING PHYTOPLANKTON BLOOMS AND RESULTING EFFECTS ON DISSOLVED OXYGEN IN DUWAMISH RIVER ESTUARY, SEATTLE, WASHINGTON,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 05C.
W69-07507

ESTUARINE WATER QUALITY MANAGEMENT,
California State Water Resources Control Board, Sacramento. San Francisco Bay-Delta Program.
For primary bibliographic entry see Field 05G.
W69-07522

MIXING OF COLUMBIA RIVER AND OCEAN WATERS IN SUMMER,
Washington Univ., Seattle. Dept. of Oceanography; and Smithsonian Institution, Washington, D. C.
T. John Conomos, and M. Grant Gross.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA5, Pap 6187, pp 979-994, Oct 1968. 16 p, 10 fig, 22 ref.

Descriptors: *Estuaries, *Columbia River, *Mixing, *Sea water, *Streamflow, *Pacific Ocean, Nutrients, Dissolved solids, Salinity, Currents (Water), Water quality, Circulation, Eddies, Saline water-freshwater interfaces.
Identifiers: Upwelling (Water).

Mixing between Columbia River water and the adjacent ocean water is a 2-stage process controlled primarily by high river discharge. The first-stage mixing, of fresh water of the river and upwelled deeper ocean water, occurs within the estuary and yields low-salinity water. The second-stage mixing, of seaward-flowing low-saline water and deeper ocean water, occurs primarily in the transition area within 20 km of the river, and adds additional nitrate and phosphate. During summer the river is the dominant contributor of dissolved silicate. Because of summer photosynthetic depletion, the river contributes virtually no nitrate; the deep ocean water contributes most of the phosphate and nearly all the nitrate. In the oceanic area, the low-salinity surface water lies above the surface ocean water which inhibits further upward nutrient transfer by mixing. Nitrate is depleted within 30 km of the river. The lack of nitrate therefore limits photosynthetic activity in the surface ocean layers. (Knapp-USGS)
W69-07523

DYNAMIC DIVERSION: INFLUENCE OF LONGSHORE CURRENT-TIDAL FLOW INTERACTION ON CHENIER AND BARRIER ISLAND PLAINS,
California Univ., Davis. Dept. of Geology; and California Univ., Bodega Bay, Calif. Bodega Marine Lab.
Thomas W. Todd.
J. Sediment Petrol, Vol 38, No 3, pp 734-746, Sept 1968. 13 p, 2 fig, 27 ref.

Descriptors: *Sedimentation, *Beaches, *Deltas, *Tidal effects, *Littoral drift, Mississippi River, Gulf of Mexico, Ocean waves, Tides, Currents (Water), Intertidal areas, Bed load, Suspended load, Hydraulics.
Identifiers: *Chenier plains, Mississippi delta, Barrier islands.

Chenier and barrier island plains are characteristic products of post-Pleistocene sedimentation along the northern and western coasts of the Gulf of Mexico, but similar features may be recognized throughout the world. These plains have been formed by net progradational displacement of the sea throughout the latest 3,000 to 5,000 yr period of sea level stability. They consist of low, narrow, well-sorted shell and sand ridges that are elongate parallel with the former shoreline, and which are separated by tidal mud flats or zones of poorly sorted, fine sand. A correlation has been established in the vicinity of the Mississippi River delta, by means of radiocarbon dating, between low rate of fine sediment discharge into westward moving longshore currents, stability or minor recession of the downdrift shoreline, and slow accretion of well-sorted chenier beach ridge sand. High rate of sediment discharge into nearshore currents, however, coincides with rapid progradation of sandy, silty mudflat deposits along the downdrift shoreline. It is suggested that the presence of a high content of fine sediment in longshore currents changes their fluid dynamic characteristics in such a way as to enhance traction transport, inhibit separation of differing grain size modes, and thus promote deposition of unsorted detritus. Light sediment loads halt rapid progradation and induce reworking of previously accumulated sediment. Thus no change in general wave regime is required to account for alternation of chenier sand accumulation with interchenier mudflat deposition. (Knapp-USGS)
W69-07525

SEDIMENTARY PROCESSES OPERATIVE ALONG THE WESTERN LOUISIANA SHORELINE,
Continental Oil Co., Ponca City, Okla.
Arthur O. Beall, Jr.
J. Sediment Petrol, Vol 38, No 3, pp 869-877, Sept 1968. 9 p, 10 fig, 12 ref.

Descriptors: *Sedimentation, *Gulf of Mexico, *Beaches, *Louisiana, Tidal effects, Currents (Water), Littoral drift, Mississippi River, Ocean waves, Bed load, Suspended load, Hydraulics, Provenance.
Identifiers: Tidal currents.

Investigation of modern facies relationships along the southwestern Louisiana shoreline demonstrates the complex interaction of sediment supply and energy of coastal processes. Shallow water 'wave energy' and proximity to suspended mud supply are qualitatively shown to be dominant variables. Facies tracts show variation through a broad spectrum of geometries and sediment types. Mudflats, both intertidal and subaqueous, show highest rates of progradation, as compared to 'normal' sand-rich beaches with low rates of progradation. An intermediate type of strandline, represented by a thin sand beach resting on eroded mudflat and marsh sediment, is shown to prograde at rates intermediate between those of mudflats and normal beaches, even though geometrical relationships would suggest retrogradation. Consideration of the interaction of various partially dependent sedimentary processes outlined in this paper can be used to characterize rates of progradation as well as to predict sediment type and geometry. (Knapp-USGS)

W69-07526

SUBMERGENCE ALONG THE ATLANTIC COAST OF GEORGIA,
Geological Survey, Richmond, Va.
Robert L. Wait.
Geol Surv Res 1968, Prof Pap 600-D, pp D38-D41, 1968. 4 p, 3 fig, 1 tab, 5 ref.

Descriptors: *Submergence, *Atlantic coastal plain, *Georgia, Subsidence, Estuaries, Radioactive dating, Carbon radioisotopes.
Identifiers: Glynn County (Ga), Brunswick River, Turtle River.

Cypress stumps recovered from river terrace material near Brunswick, Ga., may indicate submergence of the Atlantic coastal area during Holocene geologic time. The older material, found at a depth of from 9 to 17 ft below mean sea level, was dated by carbon-14 at 3, 670z or minus 300 years (B. P., 1950); the younger, found 1 ft above mean sea level and buried in 3 ft of marsh silt and clay, was dated at 2,780 and or minus 250 years B.P. Presence of the cypress stumps may indicate that fresh water once discharged from the Turtle River, now a drowned estuary. (Knapp-USGS)
W69-07533

THE PATTERN OF SEDIMENT MOVEMENT IN THE RIVER TYNE,
Department of Water Resources (England). Devon River Authority.
David G. Hall.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 117-142, 1967. 26 p, 16 fig, 2 plate.

Descriptors: *Sediment transport, *Sedimentation, *Estuaries, Tides, Currents (Water), Sediment load, Sediment yield, Sediment discharge, Streamflow.
Identifiers: River Tyne (England).

The movement of sediments in the River Tyne and the Tyne estuary, northeast England, was studied in conjunction with a survey of the tidal hydraulics of the estuary. The mean annual discharge of the river is 1,452 cfs. Suspended load was estimated to be 132,000 tons per yr and bed load, 20,000 tons per yr. The amount entering from the sea is estimated from dredging records to be 120,000 tons per yr. Currents and sites of deposition are shown by maps and sections. (Knapp-USGS)
W69-07544

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SCALE REDUCTION IN DESALINATION BY CALCIUM SULFATE SOLUBILITY INVERSION,
Rhode Island Univ., Kingston. Water Resources Center.
A. Ralph Thompson.
Completion Report OWRR Project A-012-RI, 1968. 16 p.

Descriptors: *Desalination, *Scale prevention, *Evaporation, *Additives, *Solubility, *Calcium Sulfate, *Heat transfer.
Identifiers: *Acrylic acid-amide copolymers, *Polyhall 295, *Sodium acrylate, *Cyanamer P35, *Polyacrylamides.

The purpose of this research was to find a method for reducing or eliminating calcium sulfate scale in saline water conversion processes by employing distillation or evaporation. The principle of the proposed method depends on the use of the additives to sea water which would give calcium sulfate a normal rather than inverted solubility behavior so it would not tend to deposit on heat transfer surfaces. After determining extensive data on almost fifty compounds, only three were found which, in relatively low concentrations, had the characteristics of holding the transient solubility of calcium sulfate in sea water practically invariant with temperatures up to about 255 deg. F. These compounds were (1) sodium acrylate (2) an anionic polyacrylamide and (3) an acrylic acid-amide copolymer. Tests run in an experimental evaporator using 10 - 20 p.p.m. of these promising additives showed remarkable reduction in scale formation on heat transfer surfaces. Preliminary economic evaluation indicated that the cost of additives may be reduced to one or two cents per 1000 gallons of fresh water produced.
W69-07469

DISPOSAL OF THE EFFLUENTS FROM DESALINATION PLANTS: THE EFFECTS OF COPPER CONTENT, HEAT AND SALINITY,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 05C.
W69-07476

DISPOSAL OF THE EFFLUENTS FROM DESALINATION PLANTS INTO ESTUARINE WATERS,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 05C.
W69-07477

SALINE WATER CONVERSION REPORT FOR 1968,
Office of Saline Water, Washington, D. C.
W. S. Gilliam.
Office Saline Water 1968 Rep, 1969. 489 p, 404 fig, 97 tab, 314 ref, 6 append.

Descriptors: *Desalination, *Research and development, Membrane processes, Desalination processes, Water purification, Aqueous solutions, Thermodynamics, Byproducts, Corrosion, Electrochemistry, Potable water, Saline water, Water chemistry, Distillation.
Identifiers: Office of Saline Water.

Desalination research, while maintaining a program of basic studies relevant to desalting, continues to emphasize applied research and the development of desalting technology. During 1968, the major portion of the research effort was concentrated in the fields of membrane technology, materials, design, and configuration studies of prototypes involving tubes, spirals, and composites for membrane processes and basic and exploratory research. It is believed the need for increased emphasis on these activities, plus a much greater effort in the fields of pretreatment of feed water, contaminated water, biomembranes, mineral recovery, new processes, and others, will be essential in the next few years. Research continues to emphasize the development of less costly materials having a potential for reduction of plants costs. The principal objective of the program is the development of the lowest cost desalination processes possible for use under a variety of conditions. Research progress during calendar 1968 is summarized in the reports of the five operating research divisions: Polymer and Biophysics, Applied Science, Materials, Chemical Physics, and Chemistry. (Knapp-USGS)
W69-07511

TRANSPORTATION OF DEMINERALIZED WATER,
San Diego Dept. of Utilities, Calif.
Roy E. Dodson.
ASCE Proc, J Sanit Eng Div, Vol 94, No PL1, Pap 6191, pp 127-135, Oct 1968. 9 p, 1 tab, 12 ref.

Descriptors: *Demineralization, *Pipelines, *Corrosion, *Corrosion control, *California, Water distribution (Applied), Transportation, Metal pipes, Concrete pipes, Steel pipes, Tiles, Distribution systems, Water treatment.
Identifiers: *Demineralized water.

The delivery of demineralized water through existing distribution systems must be preceded by careful studies, and proper treatment or blending methods must be provided to avoid poor water quality and rapid corrosion. Experiences at San Diego in 1962-1964 indicate that distilled seawater can be successfully carried in an old tuberculated cast iron main grid after treatment with limestone and blending with Colorado River water. Limestone treatment alone is inadequate to protect new asbestos cement pipe from attack. A new facility placed in service in 1967 delivers distilled seawater to another section of San Diego after blending with highly mineralized well water. Provision has been made to study the effects of pure and blended waters on various pipe materials. The importance of temperature limits for consumer satisfaction is described. The very citations found on the subject in the literature are included. (Knapp-USGS)
W69-07524

ON THE OPTIMAL DESIGN OF DESALINATION PLANTS,
Kansas State Univ., Manhattan.
L. T. Fan, L. E. Erickson, C. Y. Cheng, and C. L. Hwang.
Proc, Nat Symp Anal Water-Resource Syst, pp 37-63, Denver, July 1968. 27 p, 13 fig, 6 tab, 28 ref.

Descriptors: *Desalination plants, *Optimization, *Design, Flash distillation, Reverse osmosis, Water supply, Water treatment, Mathematical models, Economic justification, Operating costs, Construction costs, Simulation analysis.
Identifiers: Multieffect multistage flash distillation, Search techniques.

The optimal design of desalination plants was described as one aspect in the optimization of water resource systems. Two investigations involving the optimization of a multieffect, multistage flash distillation process and a reverse osmosis process were summarized to illustrate systems analysis procedures and to illustrate the results obtained from that type of investigation. In order to optimize the process design, a mathematical model related the design variables to the behavior of the physical system, an economic model related the design variables to capital and operating costs, an objective function (minimization of water production cost) and an optimization procedure were used. It was demonstrated that a combined optimization technique based on a discrete analog of the maximum principle and search techniques such as the parametric search and gradient technique were quite efficient for the study of a multistage multidecision process. Some composite desalination systems which were currently being investigated were introduced. For main entry see W69-07562. (Gysi-Cornell)
W69-07563

3B. Water Yield Improvement

THE ASPHALT MOISTURE BARRIER FOR FARMING DROUGHTY SOILS,
International Harvester Co., Chicago, Ill. Product Planning Research; and American Oil Co., Whiting, Ind. Research and Development Dept.
R. E. Baumheckel, L. C. Brunstrum, J. B. Corns, and T. L. Speer.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 22 p, 6 tab, 10 fig, 8 ref.

Descriptors: *Soil treatment, *Water yield improvement, *Arid lands, Deserts, Subsurface drainage, Permeability, Infiltration, Soil water, Water conservation, Oil industry, Retardance, Retention, Water utilization efficiency, Water proofing, Crop production, Crop response, Economics, Irrigation efficiency, Cost-benefit analysis, Asphalt, Barriers, Soil moisture, Equipment.

The evolution of equipment development is explained, as is moisture retention properties, increases in crop yields and economics of asphalt moisture barriers (AMB). The AMB machine mounted on a TD-25C gear driven crawler tractor with a crew of two men is expected to lay from 1.0 to 1.5 acres of barrier per hr. at a depth of 2 ft. Reduction of infiltration rate from 3 in. to about 0.6 in per hr. has been demonstrated. In Arizona irrigation usage was reduced to 47% of the control plot. The barrier without irrigation produced better crop yields than the irrigated control, and frequently better than irrigated barrier plots. The principal cost is asphalt. Under present U.S. economic conditions a barrier can be installed for $200 to $300 per acre. The payout for the farmer will be from one to four years, and the barrier could last fifteen years. (Sherbrooke-Ariz)
W69-07344

LOCAL WATERS OF THE ARID ZONE OF THE USSR AND THEIR UTILIZATION,
Akademiya Nauk SSSR, Moscow. Institut Geografii.
V. N. Kunin.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 12 p, 6 ref.

Descriptors: *Arid lands, *Saline water, *Water utilization, Deserts, Basins, Runoff, Standing waters, Surface-groundwater relationships, Desalination, Stockwater, Water consumption.
Identifiers: *U.S.S.R.

The area of the U.S.S.R's arid zone is about 3 mmln. sq. km. Development depends on the use of transit streamflow, underground water, and precipitation. Traditional methods (i.e. wells) of underground water use are very limited by high salinity. Surface runoff collection by native populations in floating freshwater lenses on saline groundwater and modern efforts are considered. Each 100 sq km of pasture with 1,500 sheep needs only 0.04 sq. km. of artificial drainage area with an annual runoff of 75 mm. Stock can consume mineralized water, and procurement of freshwater for man is no problem. The upper salinity limit for stock water is 12,000-15,000 p.p.m. and for irrigated cultivation of stock fodder is 10,000-15,000 p.p.m. Large freshwater lenses have been discovered and economic methods of underground water intake were introduced, preventing salt water intrusion. A method of natural freezing desalination is mentioned. Acceptability of total river runoff utilization, and its resulting consequences in the large inner drainage basins that form the Caspian Sea, the Aral Sea and other isolated waters, is presently being debated in the U.S.S.R. (Sherbrooke-Ariz)
W69-07352

WATER USE BY SALTCEDAR VARIES WITH MANY FACTORS,
Geological Survey, Lubbock, Tex.; and Texas Technological Coll., Lubbock.
T. E. A. Van Hylckama.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 20 p, 4 tab, 7 fig, 11 ref.

Descriptors: *Tamarisk, *Evapotranspiration control, Evapotranspiration, Arid lands, Consumptive use, Phreatophytes, Riparian plants, Riparian water loss, Phreatophyte control, Moisture availability, Water table, Bank storage, Growth rates, Salt tolerance, Saline water, Soil-water-plant relationships, Soil moisture.
Identifiers: *Evapotranspirometers.

Three years of observations on water use by saltcedar, conducted in a battery of evapotranspirometers (tanks), resulted in reliable answers to questions of phreatophyte waste. The quantity of water evaporation or transpiration depends on the depth of groundwater. It also depends on the salinity of the soil moisture. In soils which have an electrical conductivity of saturation extract of 30 millimhos, water use is half that of those having 10 millimhos. With low salinity of soil moisture salt cedar sprouts grow faster than under high salinity conditions. Growth characteristics between controlled and thinned-out stands are not significant. Thinning and cutting are shown to be ineffective methods of saving water. Under favorable conditions shoots can increase by as much as 50 mm per day. Methods of vegetation survey and extrapolation of water use as measured in evapotranspirometers to a 100% density can seriously overestimate water use as a 75% cover density may use as much water as 100%. Programs of saltcedar eradication along dry river beds with water table at 4 meters for the purpose of saving water are seriously questioned as to effectiveness. (Sherbrooke-Ariz)
W69-07359

A RECONNAISSANCE OF THE GROUNDWATER GEOLOGY OF MONTVILLE TOWNSHIP, MEDINA COUNTY, OHIO,
Kent State Univ., Ohio. Dept. of Geology.
For primary bibliographic entry see Field 04B.
W69-07492

WATER RESOURCES OF THE BIG OTTER CREEK DRAINAGE BASIN,
Water Resources Commission (Ontario).
U. Sibul.
Ontario Water Resources Comm, Water Resources Rep 1, 1969. 91 p.

Descriptors: *Water resources, *Groundwater, *Surface waters, Water wells, Water quality, Aquifers, Glacial drift, Water yield, Water levels, Discharge (Water).
Identifiers: *Ontario, Big Otter Creek Basin.

Field investigations were made of surficial geology, surface-water flows, and farm water use in the Big Otter Creek Basin, Ontario. Observation wells were installed and water samples were collected for chemical analysis. A simplified hydrologic budget is presented. The only area in the basin where there is difficulty in obtaining sufficient ground-water supplies of acceptable quality is in the southern portion. Ground-water supplies in the rest of the basin are derived from sand and gravel aquifers and water-bearing zones in the upper portions of the bedrock. Most of these waters are of good quality for domestic, stock and irrigation purposes. Surface-water supplies are utilized mostly for irrigation, and at most locations are adequate in quantity and quality. Stream runoff, composed to a large degree of ground-water discharge, is the main source of surface-water supply. The withdrawal of water during short periods of irrigation in July and August has a marked effect on the streamflow of Big Otter Creek. In the 1964-65 water year, total precipitation for the basin was 30.81 inches, or 6.85 inches below the normal. Stream runoff was 15.10 inches, and evapotranspiration was 15.71 inches. The water resources were found to be generally adequate for the present uses in the basin; however, local shortages and quality problems exist and require special development and management practices. (Knapp-USGS)
W69-07508

REGIONAL HYDROGEOLOGY OF THE NAVAJO AND HOPI INDIAN RESERVATIONS, ARIZONA, NEW MEXICO, AND UTAH,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-07512

WATER RESOURCES OF THE BUFFALO RIVER WATERSHED, WEST-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
R. W. Maclay, L. E. Bidwell, and T. C. Winter.
Geol Surv Hydrol Invest Atlas HA-307, 3 sheets, 1969. 31 fig, 14 maps, 2 tables.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Minnesota, Streamflow, Runoff, Water levels, Water wells, Aquifers, Glacial drift, Sands, Gravels, Recreation, Irrigation water, Water quality, Water utilization.
Identifiers: Buffalo River Watershed (Minn).

The water resources of the Buffalo River watershed, west-central Minnesota are described in a 3-sheet hydrological atlas consisting of maps, graphs, charts, and text. The annual runoff ranges from 0.7 to over 3.2 inches and averages 1.4 inches. All but 1 of the communities of the area use groundwater. Irrigation water is obtained from streamflow, and more could be developed with reservoirs. Flooding is caused mainly by snowmelt and spring rains. Most groundwater is obtained from glacial drift aquifers; supplies are adequate for domestic and stock use everywhere, and large supplies may be obtained from sand and gravel lenses. Water quality is suitable for most uses. Runoff data are summarized by hydrographs. Surficial geology, water use, streamflow, aquifers, water yields, water levels, water quality, and recreational use are shown by maps. (Knapp-USGS)
W69-07513

WATER RESOURCES OF THE OTTER TAIL RIVER WATERSHED WEST-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
T. C. Winter, L. E. Bidwell, and R. W. Maclay.
Geol Surv Hydrol Invest Atlas, HA - 307, 4 sheets, 1969. 31 fig, 2 tab, 22 maps.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Minnesota, Streamflow, Runoff, Water levels, Water wells, Aquifers, Glacial drift, Sands, Gravels, Recreation, Irrigation water, Water quality, Water utilization.
Identifiers: Otter Tail River Watershed (Minn).

The water resources of the Otter Tail River watershed, west-central Minnesota are described in a 4-sheet hydrological atlas consisting of maps, graphs, charts, and text. Large amounts of groundwater are available from sand and gravel deposits along the Otter Tail River. Yields of over 1,000 gpm are available. Most of the water has low sodium hazard and medium salinity hazard, and is suitable for irrigation on most soils. Average runoff is 1.9 in per year. Flooding is minor and usually caused by ice jams. Water based recreational opportunities are very good, particularly for canoeing. Runoff data are summarized by hydrographs. Surficial geology, water use, streamflow, aquifers, water yields, water levels, water quality, and recreational use are shown by maps. (Knapp-USGS)
W69-07514

ROUND VALLEY RESERVATION SPRUCE RUN RESERVATION.
For primary bibliographic entry see Field 06E.
W69-07588

WATERS AND WATER SUPPLY.

N J Stat Ann secs 58:22-1 to 58:22-4 (1966).

Descriptors: *New Jersey, *Delaware River, *Reservoirs, *Water storage, Water resources development, Legislation, Water policy, Water management (Applied), Dams, Watersheds (Basins), Planning, Construction, Costs, Feasibility studies, Streamflow, Water works, Water supply, Reservoir construction, Reservoir sites, Administrative agencies.
Identifiers: *Raritan River.

In order to augment natural water resources and to provide for a long-range program of development the Department of Conservation is authorized to expend $39,500,000 from the New Jersey Water Bond Act, 1958, for: (1) a 55 billion gallon reservoir in Round Valley, the source of waters for

which is to be the south branch of the Raritan River or the Delaware River; (2) a 10 billion gallon reservoir to be constructed by dams on Spruce Run and Mulhockaway Creek, tributaries of the Raritan River; (3) carrying out a 10 year program of geological and hydrological studies to determine ground-water resources; (4) determining the feasibility of utilizing ground-water storage to supplement reservoir storage as a source of water supply; (5) continuing to design means of improving stream flow in the Raritan and Millstone Watersheds and to acquire real property pursuant thereto; and (6) continue to design means to improve stream flow in any other area. The terms 'department,' 'construct,' 'cost,' 'commissioner', 'council,' 'division,' 'net revenues,' 'operating expenses,' 'project,' 'real property,' and 'water supply facility' are defined for purposes of the act. (Kahle-Fla)
W69-07679

3C. Use of Water of Impaired Quality

PRODUCTIVIZATION OF SAND DESERTS BY SALINE AND MARINE AGRICULTURE,
World Academy of Art and Science, Rehovoth (Israel).
Hugo Boyko, and Elisabeth Boyko.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 9 p, 3 ref.

Descriptors: *Arid lands, *Deserts, *Salt tolerance, *Saline Water, *Sea water, Salinity, Germination, Osmotic pressure, Plant physiology, Brines, Water resources development, Land reclamation, Irrigation practices, Crop response, Soil-water-plant relationships.
Identifiers: *Saline agriculture, *Marine agriculture.

This is a review of the authors' and others' work, with recommendations for worldwide implementation. About 40 economic species have been grown with saltwater up to oceanic concentration, in various countries, and more than 250 species with saline waters, mainly desert underground waters with a total salt concentration of 2,000 to 10,000 p.p.m.T.D.S. Recent experiments proved that seedlings will grow at higher salt concentrations than before thought when many varieties of each species are tested. Fresh water for germination and growth of seedlings is advisable, but more study is needed on salt-sensitivity stages of cultivated plants. Juncus arabicus germinates in waters up to 9,000 p.p.m. chlorine. Juncus seedling growth is enhanced under plastic cover because the tiny plants are sheltered against wind, benefit from higher temperature, and if irrigated with saline water, have freshwater from the dropping air moisture. Desert underground waters have a lower salinity than sea water, but a less favorable ionic balance. Evaluation is made of the ecological and physiological approaches to problems of arid lands agriculture. New principles are listed. Programs are outlined for the utilization of these findings on a worldwide scale. (Sherbrooke-Ariz)
W69-07346

TRICKLE IRRIGATION - A METHOD FOR INCREASED AGRICULTURAL PRODUCTION UNDER CONDITIONS OF SALINE WATER AND ADVERSE SOILS,
Hebrew Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 03F.
W69-07348

3D. Conservation in Domestic and Municipal Use

WATER RESOURCE DEVELOPMENT.
For primary bibliographic entry see Field 06E.
W69-07283

MUNICIPAL WATER PROBLEMS - SOME LEGAL ASPECTS,
For primary bibliographic entry see Field 06E.
W69-07452

THE ECONOMIC IMPLICATIONS OF THE INTERCONNECTION OF URBAN WATER SYSTEMS,
Temple Univ., Philadelphia.
For primary bibliographic entry see Field 06B.
W69-07468

3E. Conservation in Industry

LEASING OF OYSTER BEDS.

Del Code Ann tit 7, sec 4515 (1953).

Descriptors: *Delaware, *Oysters, *Mollusks, *Administrative agencies, Animals, Benthic fauna, Commercial shellfish, Marine animals, Shellfish, Clams, Mussels, Legislation, Regulation, Leases, Food, Oceans, Beds, Beds under water.
Identifiers: *Oyster beds, Oyster plantations.

The State Highway Department shall not lease any land used as an oyster plantation, oyster bed or oyster bottom. Nor shall the Department demise any land the use of which would affect any adjacent oyster plantation, bed or bottom in the planting, propagation or taking of oysters. (Helwig-Fla)
W69-07694

FISH.

Vt Stat Ann tit 10, secs 101-111 (Supp 1968).

Descriptors: *Vermont, *Fish management, *Fish conservation, *Fishing gear, Regulation, Legislation, Sport fishing, Fishing, Ice fishing, Nets, Hunting, Trapping, Permits, Trout, Carp, Salmon, Minnows, Suckers, Recreation, Bait fishing, Water sports, Equipment.
Identifiers: Spear fishing, Bow fishing, Bowfin, Pickerel.

Fish may be taken at any hour during the open season by use of not more than two lines per person each with one baited hook, no more than three artificial flies, or one plug, lure, or spoon. In waters other than closed trout waters two hooks may be used. Fish may be taken through the ice with not more than eight lines, tip ups or bobs, which shall be visited at least once an hour. Minnows may be taken in waters not inhabited by trout with nets not exceeding 75 feet. In trout water minnows may be taken by minnow traps not in excess of 18 inches in length with the opening not in excess of one inch. Carp, garfish, bowfin or suckers may be speared and pickerel shot by persons with hunting or combination licenses during the season provided therefor. Carp may be taken by persons with fishing or combination licenses, in the proper season, by bow and arrow with line attached. Fish may not be taken within 500 feet of waterfalls during spawning seasons of trout and salmon. Dealers in imported trout must keep their license displayed and containers labeled with the name of the supplier and kind, number and net weight of fish therein. (Kahle-Fla)
W69-07698

PRIVATE PRESERVES.

Vt Stat Ann tit 10, secs 5201-5211a (Supp 1968).

Descriptors: *Vermont, *Fish management, *Fish conservation, *Breeding, Fishing, Permits, Regulation, Legislation, Hunting, Trapping, Ponds, Streams, Fisheries, Fish farming, Fish stocking, Wildlife management, Number fish per acre.
Identifiers: *Private game preserves, Penalties, Posting.

An owner, or persons having the exclusive right to take fish or wild animals upon land or waters thereon, may prohibit hunting and fishing by posting notices on the land. Notices prohibiting fishing must show the date the water was last stocked and shall be maintained on the shoreline not over 400 feet apart. Posting must be recorded annually with the town clerk. A notice prohibiting fishing may not be maintained for more than one year after the waters were last stocked with 1,000 fry, 600 advanced fry, 3000 fingerlings, or 150 fish, for each half mile of stream or acre of pond. Fines are imposed for taking game on posted land and for damaging notices. The commissioner may issue licenses to breed fish and wild animals for one year upon application and payment of $2.00 fee. A breeder may sell fish and animals for propagation or food during seasons prescribed by the commissioner. Such fish and animals must be tagged or marked as the commissioner prescribes. A person owning a pond of less than 20 acres stocked at his own expense and with no access to other waters may take fish from such pond at any time. Persons taking game from or damaging breeding farms shall be liable in tort to the owner. (Kahle-Fla)
W69-07699

3F. Conservation in Agriculture

PROBLEMS OF MANAGEMENT OF IRRIGATION AND DRAINAGE WATERS IN THE SAN LUIS UNIT, CENTRAL VALLEY PROJECT, CALIFORNIA,
Bureau of Reclamation, Sacramento, Calif.
John W. Bailey.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 40 p, 8 fig, 4 tab, 15 ref.

Descriptors: *Arid lands, *Irrigable land, Water management, Water utilization, Saline soils, Salt balance, Permeability, Drainage water, Project benefits, Project planning, Waste water disposal, Salt tolerance, Irrigation water, Water quality, Central Valley Project.
Identifiers: San Luis Unit, Central Valley Project (Calif), San Joaquin Valley (Calif).

The San Luis Unit of the Central Valley Project of California now under construction by the Bureau of Reclamation will provide for irrigation development of arid lands whose water supply is inadequate to support existing agriculture. Various considerations of water management that relate to the project are discussed and pertinent data are presented. Environmental features are discussed in sufficient detail to indicate some of the principle considerations in water quality management. Contrasting conditions are presented for permeable well-drained and slowly permeable poorly-drained soils. Surface and groundwater criteria for mixing are discussed. Problems in prediction of salt buildup and salt balance under a mixing regime are considered. Mixing of irrigation water and disposal of drainage effluent are discussed in relation to the project. (Sherbrooke-Ariz)
W69-07343

THE ASPHALT MOISTURE BARRIER FOR FARMING DROUGHTY SOILS,
International Harvester Co., Chicago, Ill. Product Planning Research; and American Oil Co., Whiting, Ind. Research and Development Dept.
For primary bibliographic entry see Field 03B.
W69-07344

TRICKLE IRRIGATION - A METHOD FOR INCREASED AGRICULTURAL PRODUCTION UNDER CONDITIONS OF SALINE WATER AND ADVERSE SOILS,
Hebrew Univ., Jerusalem (Israel).
D. Goldberg, and M. Shmueli.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 24 p, 7 fig, 7 tab.

Descriptors: *Irrigation efficiency, Deserts, Crop response, Growth rates, Irrigation effects, Root dis-

tribution, Saline water, Distribution systems, Furrow irrigation, Sprinkler irrigation, Subsurface irrigation, Water conservation, Saline soils.
Identifiers: *Trickle irrigation.

This paper reports on experiments employing drip irrigation in the Arava desert region of Israel. The method is based on the lateral spread of water by conduction under pressure and application through special nozzles placed on a plastic conveyor pipe just above the ground in close proximity to the plants. Experimental crops included musk melons, tomatoes, cucumbers, sweet corn and peppers. Rate of growth under trickle irrigation surpassed that under sprinkler irrigation. This led to earlier, as well as higher, yields with reduced production costs, particularly water. Picking costs were reduced by uniform ripening and early market prices were higher. In many cases, under trickle irrigation, the salt concentration was the lowest possible under the specific prevailing conditions of saline water and saline soils of the area. Values for chloride content in plant leaves under trickle irrigation were between 40 to 60% of those for sprinkler irrigation. With very low rates of application the water supply very nearly equals the amount actually used by the plant. (Sherbrooke-Ariz)
W69-07348

PROBLEMS OF POLLUTION OF IRRIGATION WATERS IN ARID REGIONS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering; and Federal Water Pollution Control Administration, Ada, Okla.
For primary bibliographic entry see Field 05B.
W69-07355

POSSIBILITIES FOR REMOTE DETECTION OF WATER IN ARID AND SUBARID LANDS DERIVED FROM SATELLITE MEASUREMENTS IN THE ATMOSPHERIC WINDOW 3.5-4.2 mu,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 07B.
W69-07356

COMPARISON OF IRRIGATION METHODS IN AN ARID ENVIRONMENT,
California Univ., Davis. Dept. of Water Science and Engineering.
Frank E. Robinson, and William F. Lehman.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 8-13, 1969. 10 p, 4 fig, 12 ref.

Descriptors: *Sprinkler irrigation, *Irrigation efficiency, *Arid lands, Water conservation, Soil-water-plant relationships, Water cooling, Water utilization efficiency, Flood irrigation.
Identifiers: Imperial Valley (Calif).

Surface irrigation presently in use in the arid Colorado Desert, California, agricultural area was developed when water was adequate for luxury consumption, but present expansion of human population necessitates increased water use efficiency. Surface and sprinkler irrigation were studied in terms of changes in vapor pressure, plant temperature and soil temperature. Changes in vapor pressure were most pronounced in the sprinkler system, but did not persist at night. Both types of irrigation reduce plant temperature, but plants resumed cyclic temperature regimes afterwards. Soil surface temperature was reduced to a greater extent by sprinkler irrigation because the applied water was cooled by movement through air of low vapor pressure. Other advantages of sprinkler irrigation are enumerated. (Sherbrooke-Ariz)
W69-07357

IRRIGATION AS A MENACE TO HEALTH IN CALIFORNIA: A NINETEENTH CENTURY VIEW,
California Univ., Davis. Dept. of Geography.
For primary bibliographic entry see Field 06B.
W69-07372

HYDROGEOLOGIC CONSIDERATIONS IN LIQUID WASTE DISPOSAL,
Wisconsin Univ., Madison. Dept. of Geology.
For primary bibliographic entry see Field 05E.
W69-07375

EVALUATING RANGELAND WATER QUALITY WITH SMALL PLOT INFILTROMETERS,
Utah State Univ., Logan. Dept. of Watershed Science; and Intermountain Forest and Range Experiment Station, Ogden, Utah.
Gerald F. Gifford, and Ronald K. Tew.
J Soil and Water Conserv, Vol 24, No 2, pp 65-67, Mar-Apr 1969. 3 p, 1 fig, 2 tab, 2 ref.

Descriptors: *Infiltrometers, *Water quality, *Range management, Brush control, Clear-cutting, Irrigation practices, Runoff, Infiltration, Arid lands.
Identifiers: Rocky Mountain infiltrometer.

Use of small plot infiltrometers allows collection and analysis of both applied and runoff water in evaluating rangeland water quality changes caused by agricultural disturbance of soil. In experimental plots, a natural cover of pinyon and juniper was removed by chaining and debris was cleared in one plot, another was chained but not cleared, and a third plot was left undisturbed. A Rocky infiltrometer was used to apply high intensity rainfall on each plot at over 2.7 in/hr. Significant changes in Ca and K concentrations resulted from land treatment. The pH of all runoff from treated plots decreased, and electrical conductivity increased. There was no relationship between runoff water quality and volume or duration of runoff. (Knapp-USGS)
W69-07377

PRINCIPLES AND METHODS OF CAPACITY DETERMINATION IRRIGATION DISTRIBUTION SYSTEMS,
Middle East Technical Univ., Ankara (Turkey).
Korkut Ozal.
Middle East Tech Univ, Fac of Eng Publication No 22, Jan 1965. 138 p, 55 fig, 29 tab, 128 ref.

Descriptors: *Irrigation systems, *Irrigation design, *Irrigation water, *Water supply, Mathematical studies, Water demand, Evapotranspiration, Water circulation, Climates, Dynamics, Economic aspects, Plants, Soils, Water loss, Frequency, Probability, Experimental farms.
Identifiers: *Irrigation distribution systems, Irrigation system design, Irrigation system analysis.

After stating that the capacities of irrigation canals are determined by several parameters, such as the type of crops under cultivation, the soil, the type of irrigation system used, etc., the author develops a detailed analysis of these parameters mainly based on the analytical and experimental studies conducted by several earlier investigators. The book contains 128 references and consists of the following chapters: (1) introduction; (2) a review of the factors that affect system capacities (water requirements of plants, soil characteristics, system losses, system operation, economic aspect); (3) the principles of system designs (general, water duty, system flexibilities); and (4) conclusions. (Gabriel-USGS)
W69-07421

REDUCTION OF WATER APPLICATION LOSSES THROUGH IMPROVED DISTRIBUTION CHANNEL DESIGN,
Oklahoma Agricultural Experiment Station, Stillwater.
James E. Garton, and John M. Sweeten, Jr.
Technical Completion Report, Water Resources Research Institute, August 19, 1968. 53 p, 5 tab, 12 fig, 16 ref. OWRR Project No. A-004 Okla.

Descriptors: *Irrigation canals, *Irrigation design, *Laboratory tests, Furrow irrigation, Irrigation engineering, Hydraulic engineering, Open channels, Mannings equation.

These studies were directed toward improving the uniformity of application of water with furrow irrigation. Increased efficiency of application can best be achieved by improving uniformity. Values of Manning's n were obtained with gradually varied flow in a level ditch without siphon tubes with different diameters, spacing, and submergence. Relationships of Manning's n to the variables were determined. The tubes were primed and values of Manning's n were determined for various diameters, spacing, and submergence with spatially varied flow. The results of these studies were used to determine the uniformity of water application which could be expected with various ditch slopes and outlet arrangements. A method was derived for calculating the water surface elevations at various points in a level distribution bay without resorting to a computer solution. Various diameters of circular weirs and orifices were studied to determine the head-discharge relationship for weirs with a 45 degree slope operating as side discharge devices. Rectangular weirs of various length were studied to determine the head-discharge relationship for weirs with a 45 degree slope.
W69-07474

HYDROLOGIC RESPONSE TO IRRIGATION PUMPING IN HUALAPAI FLAT, WASHOE, PERSHING, AND HUMBOLDT COUNTIES, NEVADA, 1960-67,
Geological Survey, Carson City, Nev.
For primary bibliographic entry see Field 04B.
W69-07501

IRRIGATION IN THE RHODESIAN LOWVELD,
University Coll. of Fort Hare (South Africa). Dept. of Geography.
N. C. Pollock.
The Geogr J, Vol 134, Part 1, pp 70-77, Mar 1968. 8 p, 4 fig, 1 tab, 7 ref.

Descriptors: *Irrigation, *Irrigation engineering, *Crop production, Rainfall, Climatic zones, Water resources, Water supply, Precipitation (Atmospheric), Topography, Temperature, Soils, Mapping, Rivers, Dams, Mineral industry, Sugar crops, Watersheds (Basin), Economics.
Identifiers: Rhodesian lowveld irrigation.

After describing the geology and history of the development of the irrigation system in the lowlands of Rhodesia located in the southeastern strip bordered by Transvaal and Mozambique the author discusses the present status of agriculture and land irrigation existing in the lowlands. The future dam construction and irrigation projects to increase the agricultural economy of the area are also briefly discussed. (Gabriel-USGS)
W69-07527

WATER CONSERVATION AND IRRIGATION AGENCIES.

Ala Code tit 12, secs 297 (1) -- 297 (14) (Supp 1967).

Descriptors: *Alabama, *Water conservation, *Irrigation programs, *Irrigation districts, Legislation, Administrative agencies, Local governments, Contracts, Bids, Water supply, Impoundments, Wells, Flood control, Surplus water, Multiple purpose projects, Water rates, Water users, Taxes, Permits, Erosion control, Water management (Applied), Water resources development, Eminent domain, Soil erosion.

A state development agency, constituting an irrigation district, is authorized in the interest of conservation and irrigation. Counties may elect to become a part of the agency, the membership of which shall consist of title holders of land to be irrigated. The method of incorporating the agency and the procedures to be followed in its operation are provided. Among the power of the agency are the powers: (1) to contract; (2) to sue and be sued; (3) to enter agreements with the United States concerning water impounded by it; (4) to acquire pro-

perty; (5) to provide a water supply; (6) to develop and operate an irrigation project; (7) to provide for flood control; (8) to provide multiple purpose developments; (9) to establish rates for water sold; (10) to tax water users; (11) to control soil erosion and silt; and (12) to exercise the right of eminent domain. Prior to any construction, the department of conservation must issue a permit. Contracts for construction and purchases of materials are to be awarded on the basis of competitive bids. Bonds may be issued for the purpose of finance. (Childs-Fla)
W69-07620

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

JOHNSON V AGERBECK (SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W69-07328

ILLINOIS CENTRAL RAILROAD CO V GEORGE (DIVERSION OF SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W69-07333

FLOOD PLAIN INFORMATION OF SOUTH FORK PALOUSE RIVER AND MISSOURI FLAT CREEK, PULLMAN, WASHINGTON.
Corps of Engineers, Walla Walla, Wash.

Corps Eng Flood Plain Rep, Apr 1969. 34 p, 11 fig, 13 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *Washington, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Pullman (Wash), Palouse River (Wash), Missouri Flat Creek (Wash), Standard project flood, Intermediate regional flood.

Flooding of the South Fork Palouse River and Missouri Flat Creek, Pullman, Washington is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07370

MAN-MADE LANDFORMS IN THE NILE DELTA,
Texas Univ., Austin. Dept. of Geography.
Robert K. Holz.
Geogr Rev, Vol 59, No 2, pp 253-269, Apr 1969. 17 p, 12 fig, 19 ref.

Descriptors: *Deltas, *Land forming, *Topography, *River basin development, *Geomorphology, Human population, Agriculture, Climates, History, Maps, Deserts, Gaging stations, Precipitation (Atmospheric), Rice, Cotton, Fruit crops, Evapotranspiration, Soils, Water table.
Identifiers: *Egypt, Nile delta koms.

This paper describes the low mounds, the so-called koms, of the Nile delta, which are the accumulated debris of thousands of years of human occupation. After giving the recent map of the Mendes site, the author discusses the delta and kom landscapes, their vegetation, soil, water table, and human occupance. The author summarizes his study by stating that the koms stand out in the landscape as distinct units, both physically and culturally, and that a sharp contrast between the unirrigated koms and surrounding lush vegetation constantly reinforces the delta farmer's awareness of his dependence on the waters of the Nile River. (Gabriel-USGS)
W69-07373

SOME ENVIRONMENTAL EFFECTS OF DRAINAGE IN FLORIDA,
Central and Southern Florida Flood Control District, West Palm Beach.
William V. Storch, and Robert L. Taylor.
ASCE Proc, J Irrig and Drainage Div, Vol 95, No IRI, Pap 6460, pp 139-151, Mar 1969. 13 p, 6 fig.

Descriptors: *Drainage, *Wetlands, *Florida, *Environmental effects, Citrus fruits, Economics, Estuaries, Flood control, Irrigation, Sedimentation, Water quality, Fish, Ecology, Plants, Social aspects, Conservation, Public rights.
Identifiers: Lake Okeechobee-Everglades Basin (Fla).

In 1959, intensive agricultural development started in a 780 sq mi region lying east of Lake Okeechobee in south Florida. In this 'wetland' region of flats, sloughs and ponds effective drainage to coastal waters has been the key to agricultural expansion. By 1967 approximately 20% of the region was planted in citrus. Changes in the natural environment within the region took place almost immediately after drainage was initiated and indicates that the natural environment in adjacent areas can be affected as well. The effect of drainage on the immediate economic environment of the region has been favorable to date. However, natural environmental changes have produced tensions, with economic overtones, in the social environment resulting in conflict between agricultural and conservationist interests. Based on the experience gained in this region it is suggested that the proper function of public government is to evaluate the possible environmental effects of drainage programs and to use its financial, persuasive and regulatory powers to guide total environmental change in accordance with its estimate of the best public interest. (Knapp-USGS)
W69-07382

FLOOD PLAIN INFORMATION, CEDAR RIVER, RENTON, WASHINGTON.
Corps of Engineers, Seattle, Wash.

Corps Eng Flood Plain Rep, Mar 1969. 34 p, 5 fig, 26 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *Washington, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Renton (Wash), Cedar River, Standard project flood, Intermediate regional flood.

Flooding of the Cedar River, Renton, Washington is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07384

SPATIAL ORDER IN FLUVIAL SYSTEMS: HORTON'S LAWS DERIVED FROM MIXED HEXAGONAL HIERARCHIES OF DRAINAGE BASIN AREAS,
Harvard Univ., Cambridge, Mass. Computer Graphics and Spatial Analysis Lab.
Michael J. Woldenberg.
Geol Soc Amer Bull, Vol 80, No 1, pp 97-111, Jan 1969. 15 p, 3 fig, 6 tab, 44 ref, 1 append.

Descriptors: *Drainage density, *Drainage patterns (Geologic), *Mathematical models, Geomorphology, Computer models, Digital computers, Streams, Streamflow, Hydraulics, Thermodynamics, Entropy, Topography.
Identifiers: Hortons law, Topology, Allometric growth, Geometry.

The number of stream basin areas (that is, the number of Strahler stream segments) is predicted on the basis of a hexagonal model for basin areas. It is suggested that the number of orders and the number of basins per order balance opposing tendencies for minimum overland work for streams flowing in small basins and maximum work savings in large, as opposed to small, channels. In addition, the entropy of the system approaches the maximum possible. The model agrees with empirical data in cases where the land surface is reasonably uniform with regard to structure and lithology. The necessity for approximate geometric progressions of basin areas with order creates geometric progressions of other basin parameters, leading directly to the power function relationships between variables, known as allometric growth. This model is identical to one proposed to explain the numbers of market areas per order in a system of cities. (Knapp-USGS)
W69-07394

THE WILLAMETTE RIVER, FLOOD CONTROL OR FLOOD MANAGEMENT,
Oregon State Univ., Corvallis. Dept. of Agricultural Economics.
Daryll Raitt.
Natur Resources J, Vol 9, No 1, pp 35-52, Jan 1969. 18 p, 3 fig, 2 tab, 14 ref.

Descriptors: *Flood control, *Flood protection, *Water management (Applied), *Oregon, Flood plain insurance, Legal aspects, Social aspects, Governments, Legislation, Economics, Flood damage, Non-structural alternatives.
Identifiers: Willamette River (Oreg).

The past effectiveness of flood control programs on the Willamette River, Oregon are evaluated, the predicted effectiveness of authorized projects without other management practices is estimated, conditions for efficient flood management are outlined, and recommendations for flood management programs are made. The data used are from 2 U.S. Army Corps of Engineers reports on flood heights and damages in the area. The effects of structures in alleviating damages are shown graphically. The use of management or non-structural alternatives is stressed. (Knapp-USGS)
W69-07395

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS, IN NEBRASKA.
Corps of Engineers, Omaha, Nebr. Missouri River Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 33 p, 14 photo, 2 map, index.

Descriptors: *Water management (Applied), *Nebraska, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Nebr).

U.S. Army Corps of Engineers water resources development projects in Nebraska are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply,

water pollution, power, recreation, and flood plain studies. (Knapp,USGS)
W69-07397

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN NORTH DAKOTA.
Corps of Engineers, Omaha, Nebr. Missouri River Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 21 p, 1 map, 5 photo, index.

Descriptors: *Water management (Applied), *North Dakota, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (N. D.).

U.S. Army Corps of Engineers water resources development projects in North Dakota are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07398

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN OHIO.
Corps of Engineers, Huntington, W. Va. Ohio River Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 101 p, 2 map, 35 photo, index.

Descriptors: *Water management (Applied), *Ohio, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Ohio).

U.S. Army Corps of Engineers water resources development projects in Ohio are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07399

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN OKLAHOMA.
Corps of Engineers, Dallas, Tex. Southwestern Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 64 p, 4 fig, 4 map, 24 phot, index.

Descriptors: *Water management (Applied), *Oklahoma, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Okla).

U.S. Army Corps of Engineers water resources development projects in Oklahoma are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07400

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN OREGON.
Corps of Engineers, Portland, Oreg. North Pacific Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 85 p, 3 fig, 3 map, 100 photo, index.

Descriptors: *Water management (Applied), *Oregon, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Oreg).

U.S. Army Corps of Engineers water resources development projects in Oregon are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07401

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN PUERTO RICO AND THE VIRGIN ISLANDS.
Corps of Engineers, Atlanta, Ga. South Atlantic Div.

Corps Eng Water Resources Develop Rep, Jan 1, 1969. 27 p, 1 map, 34 photo, index.

Descriptors: *Water management (Applied), *Puerto Rico, Virgin Islands, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (P. R. and V. I.).

U.S. Army Corps of Engineers water resources development projects in Puerto Rico and the Virgin Islands are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and the status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07402

THE EFFECT OF THE BEGINNING OF A HYDROLOGICAL YEAR ON THE STATISTICAL PARAMETERS OF STREAMFLOW AND REQUIRED RESERVOIR CAPACITY (RUSSIAN),
Nauchno-Issledovatelskii Gidroenergeticheskii Institut, Tiflis (USSR).
For primary bibliographic entry see Field 02E.
W69-07403

FLOODS IN RICHMOND QUADRANGLE, NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
Roman T. Mycyk, and Gerald L. Walter.
Geol Surv Hydrol Invest Atlas HA-303, 1 sheet, 1969. Text, 7 fig, 3 tab, 4 ref.

Descriptors: *Floods, *Illinois, *Stage-discharge relations, Streamflow, Surface waters, Hydrologic data, Duration curves, Flood plains, Peak discharge.
Identifiers: *Richmond (Ill), Flood frequencies.

Hydrologic data are presented to be used to evaluate the extent, depth, and frequency of flooding in the Richmond quadrangle, northeastern Illinois. The areas inundated by floods are shown on a topographic map. Flood heights are tabulated. Flood discharges, frequencies, recurrence intervals, and depths are shown graphically. (Knapp-USGS)
W69-07405

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS, IN MONTANA.
Corps of Engineers, Omaha, Nebr. Missouri River Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 19 p, 4 fig, 7 photo, 1 map, index.

Descriptors: *Water management (Applied), *Montana, *Water resources development, Navigation, River basin development, Flood control, Multiple purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U S Army Corps of Engineers projects (Montana).

U.S. Army Corps of Engineers water resources development projects in Montana are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07495

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN MISSOURI.
Corps of Engineers, Omaha, Nebr. Missouri River Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 74 p, 27 photo, 1 map, index.

Descriptors: *Water management (Applied), *Missouri, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Missouri).

U. S. Army Corps of Engineers water resources development projects in Missouri are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07496

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN LOUISIANA.
Corps of Engineers, Vicksburg, Miss. Lower Mississippi Valley Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 133 p, 4 fig, 10 map, 80 photo, 5 tab, index.

Descriptors: *Water management (Applied), *Louisiana, *Water resources development,

Navigation, River basin development, Flood control, Multiple,purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Louisiana).

U.S. Army Corps of Engineers water resources development projects in Louisiana are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07497

WATER RESOURCES DEVELOPMENT BY U.S. ARMY CORPS OF ENGINEERS IN KENTUCKY.
Ohio River Div. Labs., Mariemont.

Corps Eng Water Resources Develop Rep, 1969. 86 p, 1 fig, 3 map, 35 photo, 1 tab, index.

Descriptors: *Water management (Applied), *Kentucky, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Kentucky).

U.S. Army Corps of Engineers water resources development projects in Kentucky are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07498

WATER RESOURCES DEVELOPMENT BY THE U.S. ARMY CORPS OF ENGINEERS IN KANSAS.
Corps of Engineers, Dallas, Tex. southwestern Div.

Corps Eng Water Resources Develop Rep, Jan 1969. 80 p, 2 fig, 4 map, 29 photo, index.

Descriptors: *Water management (Applied), *Kansas, *Water resources development, Navigation, River basin development, Flood control, Multiple-purpose projects, Hydroelectric power, Dams, River training.
Identifiers: U.S. Army Corps of Engineers projects (Kansas).

U.S. Army Corps of Engineers water resources development projects in Kansas are listed. The role of the Corps of Engineers in planning and building water resources improvements is described briefly, and the procedure for initiating such studies, authorization procedures, and status of projects are outlined. Projects described include navigation, flood control, multiple-purpose projects, river surveys, erosion control, water supply, water pollution, power, recreation, and flood plain studies. (Knapp-USGS)
W69-07499

RECONNAISSANCE OF THE RED LAKE RIVER, MINNESOTA,
Geological Survey, Washington, D. C.
L. H. Roper, R. F. Brown, and D. E. Wheat.
Geol Surv Hydrol Invest Atlas HA-299, 2 sheets, 1969. 13 fig, 6 map, 3 photo, 4 tab, 14 ref.

Descriptors: *Surveys, *Hydrology, *Recreation, *Rivers, *Minnesota, Streamflow, Hydrographs, Floods, Water quality, Sediment load, Water utilization, Navigation, Industries, Cities.
Identifiers: Red Lake River (Minn).

Results of a reconnaissance study of 185 miles of the Red Lake River, Minnesota are presented in a 2-sheet hydrological atlas consisting of maps, charts, graphs, photographs, and text. The information is intended for educators, scientists, planners, and anyone who wishes to enjoy travel on the river. Physical character, recreation sites, geology, and vegetation are shown by maps and cross sections. Streamflow is summarized in hydrographs and recession curves. Water quality is shown graphically. General discussions are given of the river, its history, hydrology, water quality, and the area's geology. (Knapp-USGS)
W69-07505

FLOOD PLAIN INFORMATION OF GRAND RIVER, INGHAM COUNTY AND EATON COUNTY, MICHIGAN.
Corps of Engineers, Detroit, Mich.

Corps Eng Flood Plain Rep, 1969. 41 p, 6 fig, 25 plate, 12 tab.

Descriptors: *Floods, *Flood damage, *Michigan, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Grand River (Mich), Ingham County, Eaton County, Standard project flood, Intermediate regional flood.

Flooding of the Grand River, Ingham and Eaton Counties, Michigan is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07509

FLOOD PLAIN INFORMATION OF BLACK RIVER, SPRINGIELD, VERMONT.
Corps of Engineers, Waltham, Mass. New England Div.

Corps Eng Flood Plain Rep, 1969. 41 p, 8 fig, 14 plate, 4 tab.

Descriptors: *Floods, *Flood damage, *Vermont, Flood plains, Flood control, Non-structural alernatives, Maximum probable flood, Historic flood.
Identifiers: Springfield (Vermont), Black River (Vermont), Standard project flood, Intermediate regional flood.

Flooding of the Black River, Springfield, Vermont is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-07510

IRRIGATION IN THE RHODESIAN LOWVELD,
University Coll. of Fort Hare (South Africa). Dept. of Geography.
For primary bibliographic entry see Field 03F.
W69-07527

GENERAL CONTROL OF A GROUP OF RESERVOIRS AND THE OPTIMUM DISTRIBUTION OF WATER RESOURCES (JAPANESE),
Tokyo Univ. (Japan). Dept. of Civil Engineering.
Yutaka Takahasi, Kuniyoshi Takeuchi, and Takashi Okuma.
J Fac Eng, Tokyo Univ, Ser A, Annu Rep No 6, pp 6-7, 1968. 2 p, 1 fig, 2 ref.

Descriptors: *Water resources, *Water control, *Reservoir storage, Reservoir yield, Water shortage, Floods, Water distribution (Applied), Water balance, Optimum development plans, Technical feasibility, Mathematical studies, Aquifers.
Identifiers: Reservoirs group control, Optimum distribution of water resources.

Because there is almost no research pertaining to the optimum operation procedures of existing water-resource systems, the authors developed an optimum operation procedure on the basis of some analytical concepts and hydrological data recorded in Japan. The optimum operation procedures of a group of water reservoirs are based on the use of 'Expected Days' and 'Priority Index' conceptions. (Gabriel-USGS)
W69-07534

JOHNSON V WILLS (DRAINAGE OVER ADJACENT PROPERTY).

220 So 2d 134-136 (La Ct App 1969).

Descriptors: *Louisiana, *Land tenure, *Surface drainage, *Prescriptive rights, Ditches, Drainage practices, Surface waters, Obstruction to flow, Natural flow, Watershed (Divides), Legal aspects, Judicial decisions, Drainage patterns (Geologic), Remedies, Relative rights.
Identifiers: Injunctions (Prohibitory).

The plaintiff and the defendant were adjacent landowners. The plaintiff sought an injunction ordering the defendant to remove dirt from a drainage ditch on the defendant's land which obstructed the natural drainage of the plaintiff's land. The defendant claimed that the natural drainage of the plaintiff's land was not across the defendant's property. The court held that the evidence showed the natural drainage of the plaintiff's property to be over the defendant's land and that the plaintiff's land had drained in that manner for more than ten years. The court stated that a lower landowner may acquire by acquisitive prescription a conventional servitude of drainage over land situated above. The court found that this servitude is permanently acquired after a ten year period. The court held that the plaintiff's prescriptive rights had accrued, and that he was entitled to injunctive relief. (Shevin-Fla)
W69-07586

WATER RESOURCES COMMISSION.

Conn Gen Stat Ann sec 25-1 thru 25-9 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Water pollution, *Flood control, *Water policy, Water resources development, Administrative agencies, State governments, Permits, Flood damage, Channels, Channel improvement, Erosion, Beach erosion, Shore protection, Navigation, Navigable waters, Harbors, Rivers, Islands, Tidal waters, Coasts, Water utilization, Wells, Legislation, Legal aspects, High water mark.

The creation of the State Water Resources Commission is authorized and its general powers are delineated. These powers relate to flood control, water resource development, shore erosion, and construction of dams, dikes, piers, and reservoirs. The commission is responsible for maintaining the navigability of the state's channels and other navigable waters and, with other state agencies, is empowered to formulate long range plans for the

preservation and improvement of water resources. Further, the commission is given some control over the maintenance of municipal water reserves and the drilling of wells in the state. (Kelly-Fla)
W69-07594

WATER RESOURCES COMMISSION.
Conn Gen Stat Ann secs 25-1 to 25-2 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Water pollution, *Flood control, *Water policy, Water resources development, Administrative agencies, State governments, Permits, Flood damage, Channels, Channel improvement, Erosion, Shore protection, Tidal waters, Navigation, Dikes, Dams, Legislation, Legal aspects, Regulation, Pollution abatement.

The Water Resources Commission is established for purposes of planning and coordinating activities concerning abatement of pollution, flood control, shore erosion, water policy, and problems involving construction of dams, dikes, and reservoirs. The membership of the commission represents the following interests: (1) the state department of health; (2) agriculture; (3) fish, wildlife and recreation; (4) manufacturing; (5) electric or water utilities; (6) municipalities; and (7) the public at large. The commission may make use of the facilities of the Agricultural Experiment Station and cooperate with any other public or private agency in carrying out its duties. Any commissioner, or any assistant or employee of the commission, may enter any premises at any reasonable time while engaged in performing his duty under the provisions of this act. (Kelly-Fla)
W69-07595

WATER RESOURCES COMMISSION.
Conn Gen Stat Ann secs 25-3 to 25-4 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Water pollution, *Flood control, *Water policy, Contracts, Navigation, Navigable waters, Channels, Channel improvement, Investigations, Harbors, Rivers, Basins, Tidal waters, Coasts, Legislation, Legal aspects, State governments, United States, Weed control, Algal control.

The Water Resources Commission is authorized to negotiate and enter into agreements or compacts with other states, and the United States, relative to flood control, river and harbor improvements, obstructions, navigation, pollution, diversion of interstate waters and the use of such waters by state or federal agencies. The commission is designated as the shore erosion agency of the state for purposes of the federal River and Harbor Act. The commission may conduct investigations and studies of conditions along the shore line, harbors, rivers, and islands within the state for protection and enhancement of public and private interests. The commission may establish limits for obstruction of channels and waterways, and may make agreements with dam and reservoir owners regarding flood control. The governor must make final approval of agreements contemplated by the commission. The commission is authorized to undertake algae abatement and weed control programs. Following public hearings, the commission may designate channels and boat basins in lands under tidal or coastal waters for improvement of general navigation and for access to deep water. (Kelly-Fla)
W69-07596

WATER RESOURCES COMMISSION.
Conn Gen Stat Ann secs 25-4a to 25-6 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Water pollution, *Flood control, *Water policy, Water utilization, Water resources development, Administrative agencies, Permits, Obstruction to flow, Erosion, Legislation, Legal aspects, Flood damage, Channels, Channel improvement, Beach erosion, Navigation, Regulation, Water quality control.

For protection of flood-prone areas, the commission may establish lines in streams and channels beyond which no obstruction will be permitted. The commission shall issue or deny construction permits based on findings of the effects of proposed encroachments on the flood-carry capacity of waterways, flood heights, and hazards to life and property. The commission may remove unauthorized or over-extended obstructions as public nuisances. The Water Resources Commission, together with the state department of health, the state board of fisheries and game, and the state development commission, is authorized to prepare a statewide, long range plan for the management of the state's water resources. The plan should include identification of quality and quantities of available water, present and projected demands, and recommended utilization of the water. The governor may require special reports upon any of these matters. (Kelly-Fla)
W69-07597

WATER RESOURCES COMMISSION.
Conn Gen Stat Ann secs 25-7a to 25-9 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Water pollution, *Flood control, *Water policy, Wells, Water utilization, Administrative agencies, Channels, Channel improvement, Coasts, Tidal waters, Navigation, Navigable waters, Shore protection, Beach erosion, Legislation, Legal aspects, Water resources development, Water supply, Permits, Gaging stations.

Approval of the commission is required before any public water system may sell its water reserves in excess of those required to maintain an adequate supply. The commission is authorized to regulate the erection of structures and work incidental thereto in the tidal, coastal, or navigable waters of the state with due regard to prevention or alleviation of shore erosion, land development, and improvement of navigation. The commission may establish seaward boundaries beyond the high water mark along tidal and coastal waters for regulation of use and for providing small boat basins. Permits from the commission are required for construction along tidal or coastal waters. The commission is directed to establish and operate stream gauging stations for water resource investigation, and is authorized to permit municipalities to divert water from any river for public or domestic use. Persons engaging in well drilling operations must register with the commission. (Kelly-Fla)
W69-07598

THAMES RIVER VALLEY FLOOD CONTROL COMM'N.
Conn Gen Stat Ann secs 25-101 to 25-102 (1958).

Descriptors: *Connecticut, *Interstate compacts, *Flood control, *Interstate rivers, Legislation, Reservoirs, Reservoir sites, Damsites, Taxes, River basins, United States, Financing, Administration, Legal aspects, Massachusetts, Project purposes, Cost sharing, State governments.

The governor of Connecticut is authorized to enter into a compact with Massachusetts for the purpose of assuring adequate storage capacity for impounding the waters of the Thames River for the protection of life and property from floods. The Thames River Valley Flood Control Commission is created and is to consist of 6 members, 3 from each state. The powers of the Commission are enumerated. The Commission shall develop a plan for flood control and for utilization of the water resources of the Thames River Valley. The credit of the signatory states shall not be pledged by the Commission. Massachusetts has agreed to the construction by the United States of four dams and reservoirs in the Thames River Valley. Connecticut agrees to reimburse Massachusetts for 40 percent of the amount of taxes lost by reason of acquisition and ownership by the United States of lands for construction of the four dams or any other flood control dam hereafter constructed. If Massachusetts acquires lands for flood control purposes and is not fully reimbursed by the United States, Connecticut shall pay its share of the excess cost as determined by the Commission. Procedure for appointing 3 commissioners and their respective tenures is provided for in the act. (Holt-Fla)
W69-07601

NORTHEASTERN WATER AND LAND RESOURCES COMPACT.
onn Gen Stat Ann secs 25-120 to 25-121 (1958).

Descriptors: *Connecticut, *Interstate compacts, *Water resources development, *State governments, Legislation, Interstate commissions, Water policy, Interagency cooperation, Water resources, Water management (Applied), Federal government, Natural resources, Water sources, Employment, Contracts, Administrative agencies, Investigations, Surveys, Project planning.
Identifiers: Constitutionality.

The northeast section of the United States is a vast area of natural resources which may be exploited effectively only through a coordinated plan of action involving all the states in the area. The purpose of this compact is to create the Northeastern Resources Commission which, it is hoped, will provide such management. While studying, investigating and planning the development of water resources, the Commission will recommend changes in law or policy to promote coordination and resolution of problems. The Commission may request funds from both the signatory states and the federal government. The Commission may contract with public or private agencies to do research. The Commission may sue and be sued. The compact shall not affect any other compact into which a party state may have already entered, nor shall it discourage additional compacts. This compact shall become effective when accepted by any three of the following states: Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, or Vermont. Thereafter, any other northeastern state may become a party by enacting the compact into law. Renunciation and withdrawal by a party state must be preceded by three year's written notice of the intention to withdraw. Such notice should be sent to the governors of the party states. The provisions of the compact are severable and the invalidity of any one provision shall not affect the validity of the act as a whole. (Stewart-Fla)
W69-07602

APPROPRIATION OF WATERS; RESERVOIRS AND DAMS.

Md Ann Code, Art 96A:10-21 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Water utilization, *Water permits, *Permits, Water management (Applied), Water allocation (Policy), Consumptive use, Administrative agencies, State governments, Dams, Reservoirs, Dam construction, Reservoir construction, Obstruction to flow, Alteration of flow, Legal aspects, Legislation, Farm ponds, Appropriation.
Identifiers: Penalties, Injunctions.

In Maryland, it is unlawful for the state or any agency thereof, person, business firm, or any state political subdivision to appropriate any state waters without the written consent of the Department of Geology, Mines, and Water Resources. Such consent is not required if state water is used for domestic and farming purposes, approved municipal water supply, and non-abandoned uses in existence on January 1, 1934. A permit is required with certain exceptions concerning size from the Department for the construction or alteration of any reservoir, dam, or waterway. Farm ponds and ponds constructed as farm ponds must meet certain

specifications in order to be exempt. Permits are also required for the construction and alteration of conduits, pipe lines, and similar devices beneath the Potomac River. Public hearings will be set on all permit applications, and limitations, concerning the date construction is to begin, and may be prescribed for granted permits. Periodic reviews of permitted uses can be conducted. Criminal penalties and injunctive powers shall serve as means of enforcement. (Wheeler-Fla)
W69-07603

FLOWAGE PETITIONS.

Conn Gen Stat Ann secs 52-446 to 52-449 (1960), as amended, (Supp 1968).

Descriptors: *Connecticut, *Mills, *Dams, *Permits, Ditches, Aqueducts, Legislation, Streams, Flow, Flow augmentation, Overflow, Damages, Easements, Obstruction to flow, Streamflow, Relative rights, Legal aspects, Local governments.

Any person who has or desires to set up a water mill upon his land may petition the superior court to improve his water power by the construction of drainage ditches, aqueducts, watercourses, or raceways if such person cannot reach an agreement with the owner of any land affected by such structures as to damages that will be paid. The petition shall contain a description of the land to be overflowed and of the structure (its location, height, and dimensions). The petition shall be heard by a committee of three disinterested property owners of the county who shall determine whether the flowing will be of public use, the structures' dimensions, the length of time during which the structure may be kept up each year, and the damages to be paid. The committee shall report its findings to the court which shall add fifty percent to the damages so assessed. The sum so computed will be paid as compensation for the right to overflow. No structure may be erected to the injury of any lawfully existing mill. Any interested person may object to the committee's report for irregularity or misconduct, but, if accepted, the report shall be final except upon the question of damages. The court may set aside the report for any reasonable cause and make its own inquiry. (Kahle-Fla)
W69-07613

HALE V HULIN (DRAINAGE).
130 So 2d 519-520 (La Ct App 1961).

Descriptors: *Louisiana, *Drainage, *Drains, Drainage practices, Surface drainage, Ditches, Water conveyance, Competing uses, Water law, Judicial decisions, Legal aspects, Surface runoff.
Identifiers: *Servitude of drain.

At issue here was plaintiff's claim to a servitude of drain, which drain consisted of a man-made ditch across a portion of defendant's property. The lower court rendered judgment for plaintiff and the third circuit court of appeals of Louisiana affirmed. The court stated the well-settled Louisiana rule that a drainage ditch is a continuous and apparent servitude and may be acquired by a possession of 10 years and that under applicable case and statutory authority it was clear that defendant's property has become burdened with a servitude of drain in favor of plaintiff's property if it is shown that the ditch has been in existence in excess of 10 years prior to the date suit was filed. The drainage ditch here had clearly been in existence for more than 10 years for which reason the court affirmed the judgment appealed from. (Carruthers-Fla)
W69-07615

SYSTEM OF COUNTY DRAINAGE.

Ga Code Ann secs 23-2501 thru 23-2573 (1966), as amended, (Supp 1968).

Descriptors: *Georgia, *Drainage districts, *Drainage systems, *Water management (Applied), Legislation, Local governments, Drainage, Right-of-way, Easements, Administration, Canals, Dams, Surface waters, Drains, Watercourses, Levees, Land reclamation, Agriculture, Tidal marshes, Legal aspects.
Identifiers: Levee districts, Agricultural lands.

Each county in the state is empowered to establish and maintain a system of lowland drainage. Necessary rights of way and easements may be acquired for that purpose. The clerk of the superior court and the board of commissioners of roads and revenue are to constitute a court having jurisdiction to establish works for the purpose of draining and reclaiming land. The drainage of swamps, the drainage of surface waters from agricultural lands and the reclamation of tidal marshes is considered a public benefit conducive to the public health, convenience, utility and welfare. The procedures to be followed by the court and the board of drainage commissioners are provided. Regulations governing the operation of the exercise of powers by the drainage district are set forth. (Childs-Fla)
W69-07616

MANNING V HALL (MUTUAL DRAINAGE SYSTEM).

110 So 2d 424-428 (Fla DCA 1959).

Descriptors: *Florida, *Drainage systems, *Drainage practices, Ditches, Drains, Reasonable use, Competing uses, Land use, Easements, Surface drainage, Judicial decisions, Arable land, Drainage water.
Identifiers: Injunctions (Permanent), easement by implication, Revocable permissive use, Mutual drain.

On appeal from a final decree granting a permanent injunction allowing plaintiffs the right to maintain a drainage ditch across defendants' lands, the Second District Court of Appeal of Florida held that the injunction was proper and affirmed the decree. The chancellor had reached his conclusion regarding injunctive relief on the basis of a finding of an easement by implication from the circumstances of a sale of land from defendant to plaintiff. The court based its holding on a finding of a mutual drain. Though reciprocal rights in such a mutual drain normally depend upon a finding of mutual contribution of expense and labor in initial construction of a drainage system, the court here held that even though plaintiff contributed no actual expense and labor, the drainage system served the land of both parties, both parties contributed mutually to its upkeep, and plaintiffs' land was dependent upon the system as a substitute for natural drainage. Hence there existed a mutual drainage system with each party having a right to the system's continued operation with such right being enforcible by injunction. (Carruthers-Fla)
W69-07619

OWNERS OF BOOMS AND BULKHEADS.

Ala Code tit 33 secs 73, 74, (11958), as amended, (Supp 1967).

Descriptors: *Alabama, *Bulkheads, *Docks, *Riparian owners, Piles (Foundations), Rates, Legislation, Structures, Boats, Riparian rights, Navigable waters, Nonnavigable waters, Adjudication procedures, Legal aspects, Regulation.
Identifiers: *Liens, *Charges, Booms.

Any riparian proprietor who has lawfully erected any boom, bulkhead, piles or other structure in front of his property may charge any person who fastens thereto $5 per day for every boat or vessel other than a flatboat, $2 per day for each flatboat, and $.05 for every pole, log, or stick of timber or wood. Such charges shall constitute liens, on such vessels or timber with process of attachment from any court having jurisdiction over the amount claimed. (Kahle-Fla)
W69-07621

GRAMMAS V COLASURDO (PRESCRIPTIVE EASEMENT TO ENTER AND REMOVE OBSTRUCTIONS ON SERVIENT LAND).

48 N J Super 543, 138 A 2d 553-559 (1958).

Descriptors: *New Jersey, *Prescriptive rights, *Obstruction to flow, *Relative rights, Drainage, Ditches, Dams, Bogs, Surface waters, Easements, Damages, Judicial decisions, Land tenure, Riparian land, Adjudication procedure.
Identifiers: *Charges to jury, *Trespass, Cranberry bogs, Adverse use.

Plaintiff lower landowner alleged trespass by defendant upland owners in coming upon plaintiff's land to clean and widen a drainage ditch passing through plaintiff's land. Defendants had for years maintained cranberry bogs on their land and had drained the bogs by use of a dam gate and ditch over plaintiff's land. The trial judge refused to charge the jury on the theory of prescriptive rights, and there was a verdict for the plaintiff. The superior court held that the issue of prescriptive rights, though not formally joined, was tried by consent and without objection of the parties. The court felt the judge should have charged the jury that a prescriptive easement resulted from adverse, uninterrupted, and visible use for more than 20 years. The court noted that in such circumstances the upper owner could remove obstructions to his easement as long as there was no breach of the peace. The lower proprietor could not complain unless material damage to property could be shown. The court ordered amendment of the pleadings and a new trial on the issues presented. (Harris-Fla)
W69-07622

UNITED STATES V TWIN CITY POWER CO (VALUE OF WATER-FLOW AS PART OF CONDEMNATION COSTS).

350 US 222-246 (1956).

Descriptors: *Federal jurisdiction, *Flow, *Navigable waters, *Condemnation value, Navigation, Navigable rivers, Riparian waters, Multiple-purpose projects, Water policy, Legal aspects, Condemnation, Compensation, Payment, River flow, Flow control, Flow rates, Hydraulic properties, Water properties, Electric power plants, Electric power production, Hydroelectric power, Water law, Judicial decisions.

The United States brought suit to condemn land bordering the Savanna River Basin. The United States is required by the Fifth Amendment to pay just compensation for the value of condemned land. The defendant power company contended that such valuation should include the worth of the land as a site for hydroelectric power operations. Petition for certiorari was granted after the Fourth Circuit Court of Appeals held for the defendant. The court observed that Congress in approving the Clark Hill Project, for which this land was condemned, determined that its primary purpose was for improvement of navigation. Unless this Congressional policy decisions can clearly be shown to be an impossibility, the courts are not free to determine otherwise, and if interests other than navigation are served by such project, they must be deemed merely incidental. Water-power in a navigable river is not a private interest. Requiring the government to compensate for its loss would be to create private claims in the public domain. No compensation for value of waterflow is allowable. (Johnson-Fla)
W69-07623

WEED CONTROL IN INLAND LAKES.
Mich Comp Laws Ann secs 41.671, 41.672, 41.673 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Aquatic weed control, *Financing, *Poisons, Inland waterways, Local governments, Legislation, Conservation, Administrative agencies, Plant populations, Plant growth regulators, Appropriation.
Identifiers: *Town limits, *Public petitions.

he township board of any township may ap-ropriate money from its general fund for the pur-ose of controlling weeds in inland public lakes ithin the township proper. Such appropriation ıall be upon the request by petition of 25 or more eeholders within the town. Townships may com-ine for the purposes of this act. Poison shall not be sed to control weeds in inland lakes except with ıe approval and under the supervision of the de-artment of conservation. (Harris-Fla)
/69-07625

IUNICIPALITIES - PARTICULAR POWERS.
or primary bibliographic entry see Field 06E.
/69-07628

IMMONS V CLAYTON (OBSTRUCTION TO LOW OF SURFACE WATERS).

59 SW 2d 501-503 (Ark 1953).

escriptors: *Arkansas, *Dams, *Levees, *Ob-ruction to flow, Repulsion (Legal aspects), Sur-ce waters, Natural streams, Judicial decisions, egal aspects, Surface drainage, Retention, Altera-on of flow, Priorities, Drainage water, Surface ru-off.
lentifiers: Res judicata, Injunctions (Mandatory).

aintiff, an owner of higher realty, sought a man-atory injunction compelling a lower owner to emove a dam which allegedly caused flooding of a reet between the tracts. In previous litigation etween the parties, the court had found that aters collected by plaintiff on his land and sub-equently flowing over defendant's land were only rface waters. That determination was res judicata this case. Thus the dam repelled only surface ater and did not block a natural watercourse. The junction was denied since under Arkansas law a wer proprietor may protect himself from surface ater by erecting a levee where that is the practical ethod of protecting his land from surface water id where in so constructing the levee he acts in ood faith and without negligence. (Kahle-Fla)
/69-07629

LOYD V CHIPPEWA COUNTY (OBSTRUC-ION TO FLOW OF SURFACE WATER).

1 NW 2d 479-486 (Wis 1954).

escriptors: *Wisconsin, *Drainage ditches, Natural flow, *Obstruction to flow, *Repulsion Legal aspects), Surface waters, Drainage water, ikes, Damages, Easements, Local governments, idicial decisions, Legal aspects, Sewers, Snow moval, Highways, Road construction.

aintiffs sued Chippewa County for damages used when water was unable to flow through a lvert under a federal highway because a county ow plow had pushed snow into a county ditch reventing water from flowing into that ditch from private ditch on plaintiffs' land. The county had onstructed and agreed to maintain the private tch in consideration for granting of an easement. ne court held that the county was not liable for reach of contract since the easement agreement as invalid as being for a private rather than a blic purpose. The county had the same common w right as an owner of a private property to ob-ruct and divert the natural flow of surface water highway improvement or maintenance and thus ould not be liable for negligence. The county, was ot liable under section 88.38, which provided for e construction and maintenance of drainage tches where highway construction obstructed the tural flow of surface water, since the obstructing ghway was a federal highway. Judgment was versed, and the cause was remanded with rections to dismiss. (Kahle-Fla)
/69-07630

TOOKER V FEIL (OBSTRUCTION TO FLOW F SURFACE WATERS).
' NW 2d 918-920 (Iowa 1949).

Descriptors: *Iowa, *Natural flow doctrine, *Obstruction to flow, *Alteration of flow, Dams, Levees, Surface drainage, Surface waters, Judicial decisions, Legal aspects, Priorities, Damages, Maintenance, Dikes.
Identifiers: Servient land, Injunctions (Mandatory).

Plaintiffs sought damages and an injunction commanding removal of a dike constructed along the division line between two farms which prevented the natural flow of surface water. The court found that defendant's land was subservient to that of plaintiffs' and permanently enjoined the defendant from obstructing the free and complete flow of surface water. Defendant could not maintain the dike at its pre-1939 level on the theory that it had been in existence more than 10 years since a new dike, built in 1939, was a completely different dike, 12 feet south of and higher than the original dike. Plaintiffs were also awarded damages for injury to land caused by interference with the flow of surface water. (Kahle-Fla)
W69-07631

DUENOW V LINDEMAN (OBSTRUCTION TO FLOW OF SURFACE WATERS).

27 NW 2d 421-429 (Minn 1947).

Descriptors: *Minnesota, *Natural flow doctrine, *Obstruction to flow, *Ditches, Drainage, Surface drainage, Surface waters, Judicial decisions, Easements, Prescriptive rights, Natural streams, Tile drainage, Jurisdiction, Relative rights.
Identifiers: Injunctions (Prohibitory), Default judgments.

Plaintiffs sought to enjoin obstruction of a ditch on defendants' land which drained plaintiffs' upper land and to enjoin interference with plaintiffs' removal of the obstruction. Defendants, relying on their attorney's advice, inadvertently defaulted. The trial court found that plaintiffs had a prescriptive right to drain surface water into the ditch and to maintain it at a depth of five feet. On appeal, this court held the judgment void for want of jurisdiction since the question of a prescriptive right was not presented by the complaint and since the relief was in excess of that demanded. The only rights exercisable over the land by the upper and lower owners are rights to have the stream proceed across the land in its natural course. The natural right to drainage is measured according to the course of nature, while the rights under an easement are measured according to the express terms of the grant. Judgment was vacated, and defendants were granted leave to answer. (Kahle-Fla)
W69-07632

IN RE LAKE SEYMOUR (ESTABLISHMENT OF WATER LEVELS).

91 A 2d 813-818 (Vt 1952).

Descriptors: *Vermont, *Water level fluctuations, *Navigable waters, Water measurement, Water policy, Administrative decisions, Water rights, Competing uses, Prior appropriation, Public rights, Drawdown, Dams, Channel improvement, Remedies, Legislation, Lakes.
Identifiers: *Boatable water, Natural maximum level, Natural minimum level, Constitutionality.

This proceeding arose upon exceptions taken by petitioner, to the findings of fact and certificate of the Public Service Commission establishing the natural maximum and minimum levels of a lake. Petitioner owned a dam, located below the lake's outlet and had blasted out a channel that affected the natural maximum and minimum levels of the lake. Petitioner contested the findings of the Public Service Commission as not sustained by the evidence and further urged that the statute authorizing the Commission to establish the levels of the lake was unconstitutional. The court upheld the constitutionality of the statute and affirmed the findings and certificate of the Commission. The court held that since the lake was a body of 'boatable water' within the constitution, the bed of the lake is held by the people of the state in their sovereign capacity in trust for public uses, and the state must preserve the water for the common use of all. No right could be acquired by or be granted to private persons to control the water level of a boatable lake or the outflow therefrom, by artificial means for private purposes. (Carruthers-Fla)
W69-07634

BRIDGES OVER NAVIGABLE WATERS.

33 USCA secs 491-534 (1957).

Descriptors: *Bridges, *Federal government, *Legislation, *Navigable water, Bridge design, Bridge construction, Boats, Navigation, Riparian owners, Alteration of flow, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Obstruction to navigation, Corps of Engineers.

Any person may construct and maintain a bridge across any navigable waters of the United States. The bridge shall not be built, however, until plans for its construction have been submitted and approved by the Secretary of the Army and the Chief of Engineers. No bridge erected or maintained under the provisions of this chapter shall at any time unreasonably obstruct the free navigation of the waters over which it is constructed. If in the opinion of the Secretary, the bridge unreasonably interferes with navigation, he shall notify the persons owning or controlling such bridges to alter it so as to render navigation possible. Whenever a complaint is made to the Secretary of the Army stating that by the placing of any bridge, piers, or abutment in the navigable waters of the United States, the current has been so deflected as to cause the caving of banks or other serious damage or danger to property, it shall be his duty to make an inquiry, and if necessary require the owners of such bridge to repair the damage. (Smith-Fla)
W69-07641

NAVIGABLE WATERS OF MARYLAND.

33 USCA secs 465 (1967), as amended, (Supp 1968).

Descriptors: *Maryland, *Navigable waters, *Dredging, *Channel improvement, United States, Legislation, Riparian rights, Relative rights, Legal aspects, Federal project policy, Navigation, Federal government, Water rights, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Corp of Engineers.

When the Chief of Engineers is of the opinion dredging will improve navigation facilities, authority is granted to dredge in navigable waters within Maryland and outside the limits of projects for improvement of navigation facilities approved by Congress, regardless of United States riparian rights under Maryland law. (Harris-Fla)
W69-07642

CONSTRUCTION OF BRIDGES, DAMS, CAUSEWAYS AND DIKES.

33 USCA secs 401, 402 (1957), as amended, (Supp 1969).

Descriptors: *Legislation, *Federal government, *Navigable waters, Harbors, Bays, Navigable rivers, Navigation, Bridges, Dams, Dikes, Right-of-way, Regulation, Administrative agencies, Permits, Transportation, Mississippi, Illinois, *Canals.
Identifiers: Corps of Engineers.

It is unlawful to construct any bridge, dam, dike or causeway over or in any port, roadstead, haven, harbor, canal, navigable river or other navigable water of the United States without consent of Con-

gress. Plans approved by Congress must be submitted and approved by the Secretary of the Army and the Corps of Engineers. However, a state may build such structures across navigable waters located entirely within that state upon approval by the Secretary of the Army and the Corps of Engineers. It is unlawful to deviate from plans so approved. This statute is applicable to the Mississippi and Illinois Canals. Whenever the Secretary approves plans for structures across these canals, he may subject the grant to terms and conditions in the public interest. (Katz-Fla)
W69-07643

PROTECTION OF NAVIGABLE WATERS - REMOVAL OF WATER CRAFT BY THE SECRETARY OF THE ARMY.

33 USCA sec 414 (1957).

Descriptors: *Navigation, *Federal government, *Legislation, *Navigable water, Rivers, Lakes, Canals, Bays, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Sunken watercraft, Obstruction to navigation, Corps of engineers.

Whenever the navigation of any river, lake, harbor, or other navigable water of the United States is obstructed or endangered by any sunken vessel, boat, or similar obstruction, if such obstruction has existed for at least 30 days, or whenever the abandonment of such obstruction can be established in less time, the sunken vessel shall be broken up, removed, or otherwise disposed of by the Secretary of the Army at his discretion without liability for any damage to the owners of the vessel. The section also provides for the giving of notice and for the soliciting of sealed proposals for the removal of the obstruction. Any money received from the sale of such obstruction, or from any contractor for its removal, shall become the property of the United States government. (Smith-Fla)
W69-07644

EXCEPTION AS TO FLOATING LOOSE TIMBER, SACK RAFTS, ETC; VIOLATION OF REGULATIONS; PENALTY.

33 USCA sec 410 (1957), as amended, (Supp 1969).

Descriptors: *Legislation, *Federal government, *Navigable rivers, Streams, Transportation, *Rafts, Regulation, Water law, Navigation.
Identifiers: Corps of Engineers.

The prohibition against floating loose timber and logs in navigable streams and channels in the form of sack rafts shall not apply where use of sack rafts constitutes the principal method of navigation on a particular stream. However, the Secretary of the Army shall have the power to prescribe rules and regulations governing the use of sack rafts. The regulations shall be so framed as to equitably adjust conflicting interests between different methods of navigation on such streams. These regulations shall be published in such a manner as to give the best notice practicable to all affected parties. A violation of these regulations is punishable by a fine of not greater than $2,500 and/or imprisonment of not more than one year. (Katz-Fla)
W69-07645

RIVER AND HARBOR IMPROVEMENTS.

33 USCA secs 540, 541, 542, 545, 546 (1957), as amended, (Supp 1969).

Descriptors: *Federal government, *Rivers, *Harbors, *Administrative agencies, United States, Legislation, Navigation, Navigable waters, Shore protection, Shores, Erosion, Accretion, Channels, Project planning, Financing, Administration, Project feasibility, Federal project policy, Engineers estimates, Cost-benefit analysis, Boats, Industrial water, Hydroelectric power, Surveys, Measurement, Investigations, Data collections.
Identifiers: *Board of Engineers for Rivers and Harbors, Water terminals, Commerce, Chief of Engineers, U S Army.

Federal investigations and improvements of rivers, harbors, and waterways shall be under the jurisdiction of the Department of the Army. A Board of Engineers for Rivers and Harbors shall be organized and report to the United States on the desirability and cost of improvements to benefit commerce. 'Commerce' shall include use of waterways by all watercraft. The specified operations of the board shall be financed from appropriations by Congress. All reports on examinations and surveys authorized by law shall be reviewed by the Board of Engineers, and a report submitted to the Chief of Engineers so provided in this act. A preliminary examination and report of any proposed improvement shall be made as to its advisability. Every report shall contain, in addition to information concerning prospective commercial benefit, applicable data on existence and establishment of terminal and transfer facilities, development and utilization of water power for industrial and commercial purposes, and other subjects bearing upon improvements to navigation. Surveys of navigable waters shall include stream flow measurements, watershed data affecting navigation, information on shoreline configuration and the effect of erosion and/or accretion where applicable. (Harris-Fla)
W69-07661

RIVER AND HARBOR IMPROVEMENTS - RIGHTS OF WAY, PRIVATE IMPROVEMENT, INTERSTATE COMPACTS AND THE POTOMAC DRAINAGE BASIN.

33 USCA secs 558c, 565-567b (1957).

Descriptors: *Right-of-way, *Interstate compacts, *Federal government, *Legislation, Navigation, Harbors, Flood control, Piers, Bridges, Tennessee Valley Authority, New Jersey, Pollution control, State jurisdiction, Federal jurisdiction, Navigable waters, Federal - state water rights conflicts, Water resources development, Navigable rivers, Cities, Roads.
Identifiers: Corps of Engineers, Secretary of the Army.

The Secretary of the Army is authorized to grant easements for rights of way for public roads and streets on lands acquired by the United States for river and harbor and flood control improvements. Any person or corporation, municipal or private, who desires to improve any navigable river at their own expense and risk may do so upon the approval of the plans by the Secretary of the Army and the Chief of Engineers. Authority is given to the State of New Jersey to improve the channels on the New Jersey seacoast or the waters adjacent thereto. Plans for such improvements must be approved by the Chief of Engineers. Authority is also given to Maryland, West Virginia, Virginia, Pennsylvania and the District of Columbia to enter into an agreement to create the Potomac Valley Conservancy District and to establish an Interstate Commission on the Potomac River Basin. Authority is also given to Maine, New York, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, Pennsylvania, West Virginia, Kentucky, Indiana, Illinois, Tennessee and Ohio to enter into agreements for conserving and regulating the flow, lessening flood damage, removing sources of pollution, or making other public improvements on any rivers or streams whose drainage basins lie within any two or more of the above states. (Smith-Fla)
W69-07662

ACQUISITION OF LAND AND MATERIALS, REGULATION OF RESERVOIRS ON MISSISSIPPI.

33 USCA secs 591, 594, 601 (1957).

Descriptors: *Condemnation, *Mississippi River, *Federal government, *Legislation, Land, Right0-of-way, Easements, Reservoirs, Headwaters, Federal jurisdiction, Navigable water, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Secretary of the Army.

The Secretary of the Army may institute proceedings for the acquirement by condemnation of any land, right-of-way or material needed to maintain, operate or construct works for the improvement of rivers and harbors. After such proceedings are instituted the Secretary shall have the right to take immediate possession of such property, to the extent of interest to be acquired, and proceed with such public works as have been authorized by Congress. The Secretary shall prescribe such rules and regulations, with respect to the use and administration of the reservoirs at the headwaters of the Mississippi River, as in his judgment the public interest may require. Such rules and regulations shall be posted in some conspicuous place for the information of the public. (Smith-Fla)
W69-07663

COWAN V BAKER (LANDFILLS).

87 So 2d 74-77 (Miss 1956).

Descriptors: *Mississippi, *Landfills, *Relative rights, *Obstruction to flow, Deflection, Flow, Water levels, Flow control, Surface runoff, Precipitation excess, Streamflow, Alteration of flow, Natural flow doctrine, Reasonable use, Diversion structures, Damages, Diversion.
Identifiers: Injunctions (Mandatory).

The Mississippi Supreme Court affirmed on appeal a chancellor's decree awarding damages and injunctive relief against a lower lot owner for diversion of surface waters onto complainant's adjoining higher lot as a result of dirt fill construction by defendant lot owner. Defendant argued before the chancellor that the alleged damage to plaintiff's fence and flower beds was not caused by any act of defendant but by floodwaters escaping from two small creeks. But the chancellor found that some damage over and above what would have occurred had the fill not been on defendant's lot. Thus, part of the damage was a result of surface water drainage, rather than floodwater. The court affirmed this finding based upon the rule that when adjoining lots owned by different persons are on a different level, so that there will be a natural flow of rainwater from a higher to a lower level, the owner of the lower lot may fend the water therefrom, provided he does so for proper objects and exercises reasonable care to prevent unnecessary injury to a higher lot. (Carruthers-Fla)
W69-07664

DITCHES, MARSHES, MEADOWS AND SWAMPS.

Me Rev Stat Ann tit 30, ch 217 (1965).

Descriptors: *Maine, *Wetlands, *Drainage, *Marshes, Salt marshes, Swamps, Fresh water marshes, Flooding, Land reclamation, Surface drainage, Ditches, Drainage programs, Marsh management, Beaches, Grasslands, Adjudication procedure, Boundaries (Property), Financing, Legislation, Water resources development, Land tenure, Maintenance, Repairing, Assessments.
Identifiers: Fence-viewers.

Procedures for draining and improving any meadow, swamp, marsh, beach or other low land held by several proprietors are given. There are provisions for application to the proper court, appointment of commissioners to determine needs, notice to interested persons, and assessment and collection of expenses for improvements made to land. There are provisions for maintenance and repair of improvements made either by application to court or by agreement among the parties. Neces-

y expenses for repair may be assessed and col-
ted. There are provisions for appeal from the or-
rs of the commissioners. Digging and maintain-
ditches between salt marsh land under improve-
nt may be determined by agreement between
d owners or by order of fence-viewers of any
vn. (Helwig-Fla)
69-07666

**THORITY AND DUTIES OF COMM'RS PER-
AINING TO DITCHES, MARSHES,
EADOWS AND SWAMPS.**

Rev Stat Ann tit 30, secs 3251-3262 (1965).

scriptors: *Maine, *Wetlands, *Drainage,
larshes, Rivers, Streams, Flooding, Surface
ainage, Legislation, Water resources develop-
nt, Local governments, Dams, Dikes, Costs,
xes, Land tenure, Assessments.

hen it becomes necessary to drain or flow any
land held by several proprietors, they may
ply by complaint to the superior court in the
unty setting forth the proposed improvements.
e court shall cause notice to be given to any in-
ested owners not joined. If upon hearing it ap-
ars the improvements will be for the general ad-
ntage, the court may appoint 3 commissioners to
ect the improvements. They shall cause such
rk to be done as seems most beneficial. The ex-
nse of the improvements shall be apportioned
ong the several proprietors. Moneys assessed
ll be collected in the same manner as town
es. Upon completion the commissioners shall
ke a return to the court including an account of
moneys collected. Expenses shall be appor-
ned between any life tenant and landlord. The
mmissioners may enter upon, drain or flood land
ned by one not a party to the proceedings and
damage thus done shall be paid out of moneys
essed from the parties. (Helwig-Fla)
59-07667

GHTS OF WETLAND PROPRIETORS.
Rev Stat Ann tit 30, secs 3301-3312 (1965).

scriptors: *Maine, *Wetlands, *Drainage,
ams, Dikes, Maintenance, Repairing, Main-
ance costs, Construction costs, Land tenure,
amps, Drainage programs, Marsh management,
judication procedure, Boundaries (Property),
ancing, Assessments, Legislation.

er improvements have been made as provided in
chapter, repairs may be made to such in the
ne manner after complaint to the court. In addi-
the proprietors of any lowland so improved
hold regular meetings to make rules for the
intenance of such improvements. The possessor
nortgaged property shall be considered proprie-
thereof. Any 3 or more proprietors may apply
ny justice of the peace to have a meeting called.
notice shall be given all proprietors. Proprie-
shall have one vote per acre owned and may
by proxy. Necessary officers may be elected
sworn in at such meeting and the manner of
ing future meetings determined. A record of
ership and transfer shall be kept. Committees
be chosen to determine necessary repair to im-
v0ments. Expenses of repairs shall be assessed
inst each proprietor according to his interest. If
proprietor declines to cultivate, use or take
fit from his portion of land he shall not be liable
repair expenses nor entitled to vote. The as-
ation may be discontinued by 2/3 vote at a
ting called for such purpose. (Helwig-Fla)
9-07668

**'EALS FROM ACTION OF THE COMMIS-
NERS CONCERNING DRAINAGE OF WET-
NDS.**
Rev Stat Ann tit 30, secs 3351-3354 (1965).

criptors: *Maine, *Wetlands, *Drainage, *Ju-
al decisions, Swamps, Marshes, Flooding, Adju-
dication procedure, Surface drainage, Ditches, Grasslands, Legislation, Land tenure, Drainage programs, Local governments.

Any person aggrieved by the commissioners' actions concerning drainage may appeal to the court within 60 days after the return is made. The court may affirm, reverse or alter any order of the commissioners. All questions of fact may, upon motion, be tried by a jury. The commissioners before opening any floodgates or making any other passage of water or erecting any structure on the land of one not a party to the proceedings, shall give him seasonable notice of their intention. The owner may appeal such action to the court. The commissioners, upon notice of appeal, shall suspend all proceedings upon appellant's land pending outcome of the appeal. An appeal may be taken to the law court. (Helwig-Fla)
W69-07669

JURISDICTION OF FENCE-VIEWERS.
Me Rev Stat Ann tit 30, secs 3401-3403 (1965).

Descriptors: *Maine, *Wetlands, *Drainage, *Salt marshes, Ditches, Marshes, Swamps, Flooding, Drainage programs, Marsh management, Beaches, Surface drainage, Legislation, Land tenure, Repairing.
Identifiers: *Fence-viewers.

The owners or occupants of salt marsh enclosed by ditches shall maintain such ditches between their own and adjoining enclosures while improving them. Such maintenance shall be in proportion to the benefits accruing to each by such improvements as determined by the fence-viewers in such town. The fence-viewers shall have jurisdiction thereof as they do over fences. Such fence-viewer shall determine the width and depth of the ditch and the time allowed for making it. If a proprietor neglects to make repairs to his portion of the ditch, it may be done by the complainant and 2 or more fence-viewers shall make a certificate of its value. The delinquent owner shall be assessed for expenses. If any person lay his land common, determines not to improve any part of his land adjoining such ditch and gives 6 months notice to all occupants of adjoining lands, he shall not be required to maintain such ditch while his lands be common and unimproved. (Helwig-Fla)
W69-07670

COMPREHENSIVE HARBOR IMPROVEMENT ACT.

N J Stat Ann secs 40:179-1 to 40:179-77 (1967).

Descriptors: *New Jersey, *Harbors, *Port authorities, *Docks, Piers, Marsh management, Riparian land, State governments, Cities, Legislation, Real property, Construction, Maintenance, Leases, Legal aspects, Financing, Regulation, Navigable waters, Easements, Right-of-way.

This article sets forth a detailed exposition of the power of cities and harbor boards to acquire land for and to construct, maintain, and lease wharves and related industrial terminals and structures in the navigable waters adjacent to such cities. All grants of riparian and underground lands must be negotiated under the auspices of the state riparian commission. Various sections enumerate detailed bond issuing functions and requirements to be followed by the various harbor boards. The article also specifies referendum procedures to be followed under various bonding ventures. (Blunt-Fla)
W69-07671

COMPREHENSIVE HARBOR IMPROVEMENT ACT.
N J Stat Ann secs 40:179-1 to 40:179-11 (1967).

Descriptors: *New Jersey, *Harbors, *Leases, *Riparian land, Docks, Piers, State governments, Cities, Legislation, Real property, Right-of-way, Easements, Compensation, Legal aspects, Safety, Regulation, Navigable waters.

Cities have the right to build and maintain docks or wharves and collect fees for their use by the public provided the city first pays the state reasonable compensation for the riparian grant or lease of the underwater lands. Cities which have acquired leases for public streets terminating in navigable waters previous to the passage of section 40:179-1 need not pay the state additional compensation before wharf construction. The mayor of any city may appoint city harbor boards. If appointed, such harbor boards shall have charge of all waterfront property belonging to the city and of all riparian rights and lands underwater, including easements and rights of way. Harbor boards are empowered to promulgate regulations for the removal of harbor obstructions and to accomplish all other acts required to make the harbors safe for commerce. The harbor boards have the power to lease all city-owned waterfront property and structures under the standards set forth in the section. (Blunt-Fla)
W69-07672

COMPREHENSIVE HARBOR IMPROVEMENT ACT.
N J Stat Ann secs 40:179-12 to 40:179-77 (1967).

Descriptors: *New Jersey, *Riparian land, *Condemnation, *Financing, Local governments, Cities, State governments, Administrative agencies, Regulation, Government finance, Planning, Legal aspects, Construction, Navigable waters.

Harbor boards may recommend that the city government acquire additional upland, riparian land, or underwater land by purchase or condemnation. The boards may recommend that the cities secure additional grants of riparian or underwater lands from the state. The boards shall have the power to issue 'harbor improvement bonds.' This act does not affect the state's rights in any riparian lands or the jurisdiction of the state riparian commission over them. Detailed harbor bond procedures are set forth. Cities may issue bonds for the construction of industrial terminals on water front lands now owned or to be acquired by the cities. Bond issues, referenda requirements, and other fiscal matters are dealt with. Sections 40:179-68 to 40:179-77 deal with the reclamation of marshlands acquired by cities under the general provisions of this harbor improvement act. (Blunt-Fla)
W69-07673

SCHATZ V GUTHRIE (RIGHT TO NAVIGATE A TRIBUTARY).
132 NYS 2d 665-670 (N Y Sup Ct 1954).

Descriptors: *New York, *Navigable waters, *Riparian rights, *Easements, Right-of-way, Streams, Permits, Docks, Remedies, Judicial decisions, Legal aspects, Navigation, Public rights, Access routes, Tributaries, Barriers.
Identifiers: Injunctions (Prohibitory).

Plaintiffs' land lay directly north of a tributary of a navigable stream. Defendants, owners of the bed under the tributary, moved a large barge immediately south of plaintiffs' land so as to interfer with plaintiffs' use of the tributary. Plaintiffs brought this action seeking to restrain interference with their free access to the tributary. The court granted the injunction. It found from the evidence that plaintiffs were upland owners who enjoyed riparian rights and all the easements that flowed therefrom. By positioning their barge as they had, defendants improperly and unlawfully interfered with plaintiffs' right of access and their right to construct landing wharves and piers. The court indicated that the title to land under a navigable stream tributary is subject and subservient to the upland owners right of access to the navigable portion of the stream as well as their right to erect structures to enable them to reach such portion of the stream. The court also found that defendants'

actions had interfered with the public's right to navigate the tributary. (Gabrielson-Fla)
W69-07677

DOIRON V O'BRYAN (MEANING OF RIPARIAN RIGHTS IN A CONVEYANCE).

218 La 1069, 51 So 2d 628-634 (1951).

Descriptors: *Louisiana, *Riparian rights, *Alluvium, *Land tenure, Lake shores, Lake beds, Water law, Judicial decisions, Legal aspects, Dredging, Ownership of beds, Landfills, Rivers, Riparian land, Lakes, Remedies, Land forming, Land development.
Identifiers: *Riparian land conveyances, Jactitation.

Plaintiff brought this action in jactitation against defendant to determine ownership of a parcel of land adjacent to a lake. Because of erosion, for many years this land had been submerged, but due to dredging it became highland. Defendant based his claim on a conveyance from plaintiff by which the deed described the property conveyed as including all lands to the shore of the lake together with all riparian rights belonging to the vendor therein. Plaintiff claimed that defendant was only entitled to the highland existing at the time of conveyance. The court, in holding in favor of defendant found plaintiff entitled to both the highland and the submerged land. The court felt that a conveyance of all land to the shore including riparian rights constituted more than just the riparian use of the water. Such a conveyance included whatever right of ownership, however acquired, the grantor had to the bed of the lake which was covered by water. The court stated that the rights of alluvion and dereliction were not applicable to riparian owners adjacent to a lake, but that plaintiff had acquiesced to defendant's ownership to the property in question. (Holt-Fla)
W69-07678

USE AND DISPOSITION OF WATER.

N J Stat Ann secs 58:22-9, 58:22-12 to 58:22-16 (1966).

Descriptors: *New Jersey, *Water works, *Reservoirs, *Water management (Applied), Public utilities, Storage, Legislation, Eminent domain, Recreation, Streamflow, River basins, Federal government, Municipal water, Rivers, Conservation, Planning, Water rates, Gaging stations, Administrative regulation, Riparian rights, Water supply, Condemnation.

Whenever the flow of water in the Raritan River is less than the rates specified as acceptable at different gauging stations, a sufficient amount of water shall be released from Spruce Run Reservoir to make up the deficiency. The Department of Conservation shall have jurisdiction and control over water made available pursuant to this act. This control includes the power to sell to persons, corporations, and municipalities, after public hearing, and to set reasonable rates. The department shall have power to determine existing water rights in riparian owners, to acquire land necessary for a water supply facility, to receive federal aid for the construction of water supply facilities, to receive other aid or contributions, to adopt regulations for control of facilities, and to enter land to make surveys or examinations. Whenever land is taken by eminent domain proceedings the department may file with the superior court a declaration of taking setting forth a description of the property, the estate or interest being taken, and the sum estimated as just compensation, which sum shall be deposited with the court until a final determination is had. The department shall also have power to make reasonable regulations for the relocation and removal of facilities. The public utility operating the facility before relocation may continue to operate the new facility under the same terms as originally agreed. Any county, municipality, or political subdivision may sell, lease or lend land to the department for a facility. Reservoirs created pursuant to this act may be used for public recreation. (Kahle-Fla)
W69-07681

AN ACT FOR THE ESTABLISHMENT OF AN INTERIM COMM'N ON THE UPPER MISSISSIPPI RESERVOIRS.
Minn Sess Laws ch 862 (1957).

Descriptors: *Minnesota, *Water resources development, *Reservoirs, *Water pollution control, Water quality control, Water conservation, Rivers, Streams, Legal aspects, Lakes, State governments, Planning, Water policy, Water control, Legislation, Sewage districts, Mississippi River.
Identifiers: Commissions (Interim).

Minnesota created an interim commission for the proper control and regulation of the reservoirs at and near the head waters of the Mississippi River. The commission, consisting of appointed members of the state legislature, was authorized and directed to study the legal factors involved, to recommend legislation found by it to be desirable, and to contact and secure the cooperation of Minnesota members in Congress and federal agencies exercising control. The commission was to report to the governor and to the 1959 session of the Legislature. An interim commission was also created to study the problem of water pollution of state waters, to consider the feasibility of establishing sanitation districts where needed, and to recommend any and all reasonable means of effectively controlling the problems. The commission was to consist of members appointed from the Legislature, and was to report to the Legislature in 1959. (Wheeler-Fla)
W69-07682

SUSQUEHANNA RIVER BASIN COMM'N, ARTS 6, 7 and 8 (FLOOD PROTECTION, WATERSHED MANAGEMENT AND RECREATION).

Md Ann Code, Art 96A:65-67 (Supp 1968).

Descriptors: *Maryland, *River basin commissions, *Flood control, *Watersheds (Basins), Recreation, Watershed management, Basins, Drainage, River basins, Interstate commissions, Interstate compacts, Soil conservation, Forest management, Wildlife conservation, Flood plains, Eminent domain, Flooding, River systems, Multiple-purpose projects, Legislation, Regulation, Flood damage, Planning, Recreation facilities.
Identifiers: *Susquehanna River Basin Comm'n, Police power, Flood plain development, Use standards.

The Susquehanna River Basin Commission may plan, operate and maintain projects for flood plain development and flood damage reduction. After study of the flood plains, the Commission may delineate areas subject to flooding and establish use standards thereof. The Commission shall consider the welfare of the persons and land in the effected areas in setting the standards and may regulate the flood plains only with the consent of the effected signatory states. The Commission shall have the power of eminent domain in carrying out its purposes. The Commission shall promote sound watershed management practices in the basin. It shall encourage soil conservation, forest management, wildlife management and shall cooperate with the signatory states in affecting these ends. The Commission may provide for the development of recreational facilities, cooperating with the signatory states in the planning and effectuating of a program of recreation within the basin. (Helwig-Fla)
W69-07683

SUSQUEHANNA RIVER BASIN COMM'N, ARTS 9, 10, 11 and 12 (PUBLIC VALUES, HYDROELECTRIC POWER, DIVERSIONS AND INTERGOVERNMENTAL RELATIONS).

Md Ann Code, art 96A:68-71 (Supp 1968).

Descriptors: *Maryland, *River basins, *Interstate compacts, *Hydroelectric power, *Diversion, Interagency cooperation, Conservation, Interstate commissions, Rivers, Basins, Local governments, State governments, Taxes, Natural resources, Scenery, History, Dams, Hydroelectric plants, Public utilities, Withdrawal, Permits, Water shortage, Cost sharing, Administrative agencies, Regulation, River basin development.
Identifiers: Public values, Susquehanna River Basin Comm'n.

The Susquehanna River Basin Commission in considering, developing and constructing all projects under its authority, shall preserve historic, scenic and natural values in the basin. It may adopt regulations which will protect local communities. The Commission may use or authorize the use of the river for the generation of hydroelectric power and may develop facilities for the generation and transmission of such power. It shall not engage in the business of direct sale of power to consumers. It may enter into contracts with public agencies for generation and sale of hydroelectric power. The Commission may regulate withdrawal and diversion of surface and ground waters from the basin. It shall delineate areas of water shortage or emergency and regulate withdrawal accordingly by a permit system. Federal, state and local agencies and projects in the basin shall be subject to and governed by established regulations. The taxing power of signatory states is preserved. The Commission shall develop an equitable cost sharing plan for the basin projects. The Commission shall cooperate with the signatory states in effectuating the purposes of this compact. (Helwig-Fla)
W69-07684

SUSQUEHANNA RIVER BASIN COMM'N, ART 14 (PLAN, PROGRAM AND BUDGETS).

Md Ann Code, Art 96A:73 (Supp 1968).

Descriptors: *Maryland, *River basins, *River basin comm'ns, *Interstate compacts, Watersheds (Basins), River systems, Basins, Interstate rivers, Water law, Interstate comm'ns, Capital costs, Capital, Budgeting, Administration, Projects, Planning, Programs, Cost sharing, Financing, Legislation, River basin development, Water resources.
Identifiers: *Susquehanna River Basin Comm'n.

The Susquehanna River Basin Commission shall develop and adopt immediate and long-range plans for river basin development. In the development of a plan, the Commission shall give due regard to recommendations of the private and public bodies. It shall hold public hearings on all matters which it considers will materially affect the basin water resources. The Commission shall annually adopt a water resources program based on the comprehensive plan. The program shall include: water resources needs; projects to satisfy the needs; and a statement of proposed projects. The Commission shall annually adopt a current expense budget and a capital budget, including all proposed capital projects. (Helwig-Fla)
W69-07685

CONTRACTS FOR INTERSTATE BRIDGES; REPORT TO GOVERNOR; DIVERSION OF NONNAVIGABLE STREAM.

W Va Code Ann secs 17-4-34, 17-4-35 (1966).

Descriptors: *West Virginia, *Legislation, State governments, Bridges, Bridge construction, Interstate, Administrative agencies, Roads, Road construction, Non-navigable waters, Streams, Eminent domain, Diversion, Alteration of flow.

When it is necessary to connect a state road with a public highway of an adjoining state, the state road commissioner, with the approval of the governor, and by filing with the governor a written report, is authorized to contract with proper authorities in the adjoining state for the joint purchase, erection and maintenance of a bridge across the stream separating the two states. The state road commissioner, incidental to the construction and maintenance of state roads, shall have the power and authority to change or divert any stream of water which is not navigable, in order to avoid or facilitate the crossing thereof, or to economize in the construction or maintenance of any such road, or to protect the same from damage. To effect a change or diversion of any such stream, he may exercise the right of eminent domain. (Carruthers-Fla)
W69-07686

ACCRETION AND IMPROVEMENTS TO LAND ON NAVIGABLE WATER.
Md Ann Code art 54, secs 45, 46-48 (1966).

Descriptors: *Delaware, *Navigable waters, *Accretion (Legal aspects), *Riparian rights, Bank erosion, Navigable rivers, Ownership of beds, River beds, Oysters, Piers, Riparian waters, Streambeds, Rivers, Streams, Navigation, Patents, Legal aspects, Legislation, Nonnavigable water, Beds.

The proprietor of land bounding on any navigable water shall be entitled to all accretions from natural or other causes to the same extent that such right may be claimed by the proprietor of land bounding on nonnavigable water. Any such proprietor shall be entitled to the exclusive right of making improvements into the bordering waters. Such improvements or accretions shall pass with the land to successive owners. No improvement shall interfere with navigation on any stream. On or after June 1, 1941, a riparian owner may erect a pier, or other structure on his property without incurring liability for damage to any oyster bed leased on or after that date. No patent hereafter issued out of the land office shall impair the rights of riparian owners as declared herein. No patent shall hereafter issue for land covered by navigable waters. (Helwig-Fla)
W69-07693

4B. Groundwater Management

ANNUAL REPORT ON GROUNDWATER IN ARIZONA SPRING 1966 TO SPRING 1967,
C. J. Cox.
Ariz. State Land Dept., Water-Resources Rept. No 36, May, 1968. 44 p, 30 fig, 1 tab.

Descriptors: *Arizona, *Water consumption, *Groundwater basins, Arid lands, Aquifer characteristics, Withdrawal, Recharge, Water table, Underground storage, Water levels, Irrigated land.

Nearly 2/3 of Arizona's water supply is withdrawn from groundwater reservoirs, mainly for irrigation. This report includes graphs showing water levels in selected wells and estimated annual groundwater pumpage in most of Arizona. The maps show (1) depth to water, (2) change in water level, and (3) potential well production. A summary of current groundwater programs and publications dealing with Arizona is presented. Arizona is divided into 3 water provinces. The Basin and Range Lowlands province, of the south, is the best developed agriculturally and is subject to a rapid decline of water level. The plateau Uplands province, north, lacks extensive irrigated crops and suffers no large water-level decline. Groundwater withdrawal is small and water-level declines are slight in the Central Highlands province. Reduced annual groundwater pumpage for 1965 and 1966 over previous years is attributed to the planting of crops that require less water, more precipitation and increased amounts of surface water runoff. (Sherbrooke-Ariz)
W69-07337

GROUNDWATER CONDITIONS IN THE WATERMAN WASH AREA, MARICOPA AND PINAL COUNTIES, ARIZONA,
E. E. Denis.
Arizona State Land Dept, Water-Resources Report, No 37, August, 1968. 23 p, 9 fig, 3 tab.

Descriptors: *Water levels, *Water consumption, *Arizona, Groundwater, Salinity, Fluorides, Sodium, Basins, Aquifer characteristics, Arid lands, Withdrawal, Drawdown, Hydrologic data, Irrigation water, Wells, Pumping, Water quality.
Identifiers: Waterman Wash (Ariz).

This report describes groundwater conditions and water level trends in an arid Arizona basin subjected to year round crop production and recent expansion of cultivated acreage from 3,500 acres in 1952 to 19,000 acres in 1965. Most of the groundwater, in sand and gravel alluvial fill, is under water table conditions. Water level declines for 1961-66 ranged from 20 to 40 ft. Fluoride concentrations in 90% of the samples is high enough to cause rejection for public water supplies. Sodium and salinity hazard is classed as high to very high. Tailwater recirculation practices will slow down, but not stop the depletion at 260,000 acre ft/yr of the 9,240,000 acre ft (1965) supply. (Sherbrooke-Ariz)
W69-07338

THE CHANGING ROLE OF THE GROUNDWATER RESERVOIR IN ARID LANDS,
Bureau of Reclamation, Phoenix, Ariz. Geology Div.
E. E. Komie.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 5 p.

Descriptors: *Groundwater, *Water resources planning, *Arid lands, Groundwater mining, Safe yield, Aquifers, Land subsidence, Overdraft, Underground storage, Competing uses, Water users, Reasonable use, Water conservation, Impaired water quality, Water resources planning, Future planning (Projected).
Identifiers: Western United States.

Groundwater reservoirs have historically sustained much of the growth of agriculture in the Western United States. Uncoordinated groundwater development in the arid areas has resulted in extensive groundwater mining. This overexploitation has caused land subsidence and degradation of water quality. Many present large scale surface water importation projects result from declining water levels in areas where the establishment of agriculture was through the depletion of groundwater storage. Factors influencing the changing role of groundwater reservoirs are: (1) non-agricultural uses increasing faster than agricultural ones, (2) municipal and industrial water requirements displacing the same land areas previously devoted to irrigated agriculture, (3) water that was previously required for agriculture is usually more than ample to provide for this changing use, and (4) this transition of use makes more water available for reuse at localized points and with more convenience than would be associated with return flow from irrigation. These changing conditions require that groundwater reservoirs now must assume diverse functions beyond simple exploitation and become part of a total water resource system. Total water resource system planning, with the use of computer-oriented techniques, will assume new importance in the arid lands of the Western United States. (Sherbrooke-Ariz)
W69-07351

A RECONNAISSANCE OF THE GROUNDWATER GEOLOGY OF MONTVILLE TOWNSHIP, MEDINA COUNTY, OHIO,
Kent State Univ., Ohio. Dept. of Geology.
Raymond E. Zacuzzo.
The Compass of Sigma Gamma Epsilon, Vol 46, No 4, pp 207-216, May 1969. 10 p, 6 fig, 1 tab, 4 ref.

Descriptors: *Aquifers, *Geology, *Water resources, *Ohio, Glacial drift, Shales, Water yield, Wells, River basins, Specific capacity, Drawdown, Salinity, Chlorides, Sediments, Chemical analysis, Statigraphy, Economics, Permeability, Topography.
Identifiers: Medina County (Ohio), Ground-water geology.

Groundwater resources of Montville township, Ohio were investigated on the basis of topographical, geological, and hydrological data. The study shows that near-the-surface rocks consist of glacial deposits and sedimentary bedrock which contains some potable water. The bedrock, mostly consisting of shale, yields from 1 to 50 gpm to small-diameter domestic wells. Higher yields are obtained from the wells located along the walls of the major valley. It is believed that the yields can only be increased slightly by deepening the wells beyond 100-foot depths. Several wells of the township are contaminated with saline water which in places reaches a concentration of 150 ppm of chloride. (Gabriel-USGS)
W69-07492

HYDROLOGIC RESPONSE TO IRRIGATION PUMPING IN HUALAPAI FLAT, WASHOE, PERSHING, AND HUMBOLDT COUNTIES, NEVADA, 1960-67,
Geological Survey, Carson City, Nev.
James R. Harrill, and P. L. Soule.
Nev Water Resources Bull No 37, 1969. 75 p, 10 fig, 1 plate, 21 tab, 32 ref.

Descriptors: *Groundwater, *Water level fluctuations, *Water yield, *Aquifers, *Nevada, Water levels, Transmissivity, Safe yield, Hydrographs, Groundwater basins, Water resources development, Irrigation water, Water quality.
Identifiers: Hualapai Flat (Nev), Washoe County, Pershing County, Humboldt County.

A survey report of the water supply of Hualapai Flat, Nevada describes the groundwater flow system under near natural conditions. Estimated recharge and discharge are on the order of 5,000 acre-ft/yr. Estimated perennial yield is 6,700 acre-ft. All groundwater development is in the northern half of the area. Pumping during the period spring 1960 to spring 1967 has resulted in an estimated storage depletion of 22,000 acre-ft. Net pumpage during the 1967 irrigation season was estimated to be 7,400 acre-ft, which exceeds the estimated perennial yield by about 10%. Pumping is both localized and asymmetrically distributed with respect to natural discharge; consequently, a large quantity of water must be withdrawn from storage before the perennial yield can be salvaged. Before all natural discharge in the valley can be salvaged by pumping, levels at the northern end of the development may decline 150 ft or more. Transmissibility values range from less than 50,000 to more than 100,000 gpd/ft. The long-term storage coefficient for the entire area may average 12 to 13%, but locally may be as high as 20%. Chemical quality of the water in 1967 was generally satisfactory for irrigation, domestic, and stock use, except in the vicinity of the playa. Over the long term, recycling of pumped water and the possibility of migration of poor quality water from beneath the playa could result in a gradual deterioration in water quality in areas of use. (Knapp-USGS)
W69-07501

GEOHYDROLOGY AND WATER UTILIZATION IN THE WILLCOX BASIN, GRAHAM AND COCHISE COUNTIES, ARIZONA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-07506

WATER RESOURCES OF THE BIG OTTER CREEK DRAINAGE BASIN,
Water Resources Commission (Ontario).
For primary bibliographic entry see Field 03B.
W69-07508

REGIONAL HYDROGEOLOGY OF THE NAVAJO AND HOPI INDIAN RESERVATIONS, ARIZONA, NEW MEXICO, AND UTAH,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W69-07512

WATER RESOURCES OF THE BUFFALO RIVER WATERSHED, WEST-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03B.
W69-07513

WATER RESOURCES OF THE OTTER TAIL RIVER WATERSHED WEST-CENTRAL MINNESOTA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03B.
W69-07514

GENERAL SYSTEMS APPROACH TO GROUNDWATER PROBLEMS,
Arizona Univ., Tucson.
Lucien Duckstein, and Chester C. Kisiel.
Proc, Nat Symp Anal Water-Resource Syst, pp 100-115, Denver, July 1968. 16 p, 60 ref.

Descriptors: *Systems analysis, *Groundwater, *Optimization, *Decision making, *Water management (Applied), Water policy, Input-output analysis, Leontief models, Regional analysis, Social aspects, Water supply, Surface-groundwater relationships, Constraints.
Identifiers: Descriptive models, Optimizing models.

A survey of the state of the art in groundwater systems analysis, with extensions, was presented. Four levels of groundwater systems problems were discussed: optimal design of devices, intra-basin design and operation, basin-wide policy, and regional community goals. It was stated that the four levels constitute a multilevel optimization problem in that decisions at higher and lower levels influence the optimal decision policy at other levels. Several specialized tools used to study the above levels were described: (a) Direct physical models, both descriptive and optimizing; (b) Input-output analysis, both 'black-box' (e.g. Leontief) and goal seeking systems and (c) the State Variable Approach, both descriptive and optimizing, used by management to observe the behavior of the system as a result of applying an input on a state. Several solved and unsolved problems were discussed. For main entry see W69-07562. (Gysi-Cornell)
W69-07567

CALIFORNIA'S DIGITAL APPROACH TO GROUNDWATER MANAGEMENT STUDIES,
California State Dept. of Water Resources, Los Angeles.
Ernest M. Weber.
Proc, Nat Symp Anal Water Resource Syst, pp 116-120, Denver, July 1968. 5 p.

Descriptors: *Digital computers, *Groundwater, *Water management (Applied), *California, Surface-groundwater relationships, Project planning, Computer models, Analog computers, Storage capacity, Transmissivity, Mathematical models, Simulation analysis, Data collections.

The development, use, acceptance by local agencies, and future needs, of digital computer studies of groundwater management problems in California was discussed. The history of California's early project staging studies, and its initial use of analog computers was given. The development of mathematical models for simulation of the groundwater system on digital computers was outlined. The evolution from the linear models of 1961 to nonlinear models of the present was described. Use of the models to obtain quantitative values for transmissivity and storage was discussed. The cooperative investigations of several local agencies with the State were listed, and the gradual acceptance of digital models over the more educationally and visually oriented analog models was noted. Future needs in the development and collection of data for use in computer simulations were given. For main entry see W69-07562. (Gysi-Cornell)
W69-07568

ON MULTILEVEL OPTIMIZATION IN GROUNDWATER SYSTEMS,
California Univ., Los Angeles.
John A. Dracup, and Yacov Y. Haimes.
Proc, Nat Symp Anal Water-Resource Syst, pp 122-125, Denver, July 1968. 4 p, 14 ref.

Descriptors: *Optimization, *Analytical techniques, *Groundwater basins, Systems analysis, Aquifers, Dynamic programming, Linear programming, Water resources development, Mathematical models.
Identifiers: *Multilevel optimization, *Decomposition, Subsystems.

The use of multilevel optimization techniques for the solution of groundwater system problems was discussed. The concept of multilevel optimization was based on the decomposition of large scale and composed systems and then the reconstruction of the system into independent subsystems. The advantages were: (1) conceptual simplification of complex systems not otherwise solvable, and (2) reduction in dimensionality of the problem. After first level optimization of the subsystems, the subsystems were tied together through coordinator parameters which were responsible for (second level) optimization of the whole system. The application of the above techniques to the California Central Valley Project, where dynamic programming was used for first level optimization and linear programming for the second, was described. Other applications of the technique, such as a two aquifer system identification model and a reverse-osmosis desalination model were briefly described. For main entry see W69-07562. (Gysi-Cornell)
W69-07570

WELLS.

Md Ann Code Art 96A, secs 30-49 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Well permits, *Well regulations, *Drilling, Legislation, Water wells, Well casings, Logging (Recording), Well screens, Water yield, Administrative agencies, Aquifers, Groundwater, Legal aspects.
Identifiers: Penalties (Criminal).

Nothing in this title shall be construed to limit the power of any municipality or state agency to adopt regulations not inconsistent with the provisions herein. No well shall be drilled until a permit has been received from the Department of Geology, Mines and Water Resources. The driller shall give such information as the Department may require. Upon completion, a report shall be filed giving the log of each well, size and depth, diameters and lengths of casing and screen, static and pumping levels, yield of the well, and any other information the Department may require. No well driller shall construct a well for any owner who is required to obtain a permit under section 11 of this article until such permit is obtained. Owners of wells shall maintain them in accordance with Department regulations. No owner shall discharge from a well water which is allowed to run to waste. The terms 'well,' 'well driller,' 'owner,' 'person,' 'underground water,' and 'acquifer' are defined. Violations of any provisions of this subtitle are deemed misdemeanors and are punishable by fine of not more than $250 for each such violation. (Kahle-Fla)
W69-07604

4C. Effects on Water of Man's Non-Water Activities

HUERTH V TOWN OF PRAIRIE DU SAC (ROAD CONSTRUCTION OBSTRUCTING SURFACE WATER FLOW).
For primary bibliographic entry see Field 06E.
W69-07310

PARTICULAR CLASSES OF CORPORATIONS (COMPANIES FOR THE ERECTION OF BRIDGES OR CONSTRUCTION OF CANALS).

Md Ann Code art 23, secs 141-143 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Canal construction, *Bridge construction, Docks, Public benefits, Navigable rivers, Nonnavigable waters, Legislation, Contracts, Condemnation, Local governments, Compensation, Landfills, Abutments, Right-of-way, Roads, Bridges.
Identifiers: *Corporations, Deeds.

A corporation desiring to build a bridge may agree with landowners for the lands or interests therein necessary for bridge abutments, canal construction, roads, earth for construction, terminals, docks and wharves. The rights acquired shall be conveyed by deed and recorded. In case of failure to agree, disability or absence of the owners from the state, the corporation may obtain the lands by condemnation. When any bridge or canal is constructed pursuant to consent of the county commissioners as required by section 140, the corporation shall report in writing to the commissioners upon completion. The commissioners shall appoint three persons to examine the structure to determine whether it has been durably constructed in such a manner as is required to promote the public convenience. No bridge shall be erected on a navigable river, unless authorized by the State Roads Commission. (Kahle-Fla)
W69-07614

WATER CONTRACTS.
For primary bibliographic entry see Field 06E.
W69-07626

SIDEWALKS AND PAVEMENTS.

Mich Comp Laws Ann sec 41.273 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Road construction, *Drainage, *Financing, Assessments, Culverts, Bridges, Legislation, Paving, Drainage engineering, Construction costs, Legal aspects.
Identifiers: *Sidewalk drainage, *Road improvements.

Upon proper application or resolution and approval and investigation by the county road commission, any pavement or sidewalk improvement constructed shall be deemed to include all bridges, road drains, drainage structures, curbing, culverts and additional rights-of-way necessary. The expense of such improvements shall be included in the special assessment roll for the overall paving or sidewalk. (Harris-Fla)
W69-07638

4D. Watershed Protection

SUCCESS OF WATERSHED DEVELOPMENT IN LOCAL COMMUNITIES,
Oklahoma State Univ., Stillwater.
For primary bibliographic entry see Field 06B.
W69-07392

NATURAL AND MAN-MADE EROSION IN THE HUMID TROPICS OF AUSTRALIA, MALAYSIA AND SINGAPORE,
Hull Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 02J.
W69-07539

EROSION OF GRANITE TERRAINS UNDER TROPICAL RAIN FOREST IN AUSTRALIA, MALAYSIA AND SINGAPORE,
Hull Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 02J.
W69-07540

BED LOAD TRANSPORT AT FLOOD TIME,
Szkola Glowna Gospodarstwa Wiejskiego, Warsaw (Poland). Dept. of Hydraulics Engineering.
For primary bibliographic entry see Field 02J.
W69-07541

QUANTITATIVE FORMULATION OF STREAM AND WATERSHED MORPHOLOGY,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
Sam Shulits.
Comm of Surface Waters, Proc Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 201-208, 1967. 8 p, 35 ref.

Descriptors: *Bibliographies, *Reviews, *Channel morphology, Hydraulics, Regime, Geomorphology, Drainage density, Meanders, Rivers, Streams, Terrain analysis.
Identifiers: *USA, Stream morphology, Drainage basin morphology.

A review and bibliography are presented of the search in the last two decades for methods of quantitative formulation of watershed and stream morphology, particularly with respect to engineering sedimentation. The American effort is sampled by reviewing work of the U. S. Department of Agriculture, the U. S. Department of the Interior, and the U. S. Department of the Navy. (Knapp-USGS)
W69-07546

DISCHARGE FREQUENCY COMPARED TO LONG-TERM SEDIMENT YIELDS,
Agricultural Research Service, Sidney, Mont. Northern Plains Soil and Water Research Center.
Earl L. Neff.
Comm of Surface Waters, Proc, Gen Assembly of Bern (Sept-Oct 1967), Int Ass Sci Hydrol, Pub No 75, pp 236-242, 1967. 7 p, 3 fig, 3 tab, 8 ref.

Descriptors: *Sediment yield, *Discharge (Water), *Erosion control, Peak discharge, Bank protection, Bank stability, Land management, River training, Soil conservation, Stream stabilization, Water control, Watershed management.
Identifiers: *Discharge frequency.

Most long-term sediment movement by natural streams results from flows that occur more frequently than once every 10 years. However, there is a direct relationship between the variability of annual peak discharges and the amount of sediment moved by less frequent flows. In arid and semi-arid areas, which have the greatest variability in annual peak flows, only 40% of the long-term sediment load is moved by flows having a frequency of less than 10 yrs. In humid and sub-humid regions where there is much less variability in annual peak flows, over 90% of the long-term sediment movement is caused by flows that occur more frequently than once every 10 yrs. This concept can be used when designing sediment control methods in that the most efficient control depends upon the kind of flows responsible for the largest part of the total sediment movement. In arid regions, efficient erosion control requires proper management of the large, infrequent flows; whereas in humid areas control can best be done by management of the smaller, more frequent discharges. Proper design for sediment control in natural streams must take into account not only the sediment volume involved, but also the characteristics of the hydraulic forces causing movement. (Knapp-USGS)
W69-07548

MISCELLANEOUS STATUTES (WATERSHED MANAGEMENT).

Minn Sess Laws ch 644 (1957).

Descriptors: *Minnesota, *Wildlife conservation, *Wildlife management, *Water conservation, Legislation, Drainage, Flood control, Watershed management, Lakes, Ponds, Marshes, Wetlands, Hunting, State governments, Land management, Administrative agencies, Local governments.

The commissioner is authorized to acquire wildlife lands in the name of the state. The lands subject to acquisition include marsh or wetlands and their margins, including ponds, small lakes and stream bottoms, which he finds desirable for the interests of water conservation as related to wildlife development. Purchases must be approved by the Board of County Commissioners in the county where the land is located. Soil conservation district supervisors are to counsel the Board as to the best utilization of the land to be purchased and on questions of drainage and flood control. The Commissioner in the purchase of such wetlands must not interfere with or delay drainage proceedings instituted by landowners in watershed areas when such proceedings are conducted according to the Minnesota Drainage Code. Funds for carrying out this act are to be provided by a one dollar surcharge on hunting licenses. Payments to counties in lieu of taxes on lands so acquired shall be paid from these funds. (Kahle-Fla)
W69-07591

SOIL CONSERVATION DISTRICTS TO PREVENT EROSION.
W Va Code Ann secs 19-21A-2, 19-21A-5, 19-21A-8, 19-21A-13C (1966).

Descriptors: *West Virginia, *Erosion control, *Soil conservation, *Flood control, Land use, Legislation, Crop production, Cities, Flood protection, Dikes, Storm runoff, Water supply, Bodies of water, Sedimentation, Projects, Navigation, Fish food organisms, Permeability, Soil stabilization, Recreation, Topsoil, Porosity, Soil surfaces, Drainage water, Public health.

It has been recognized by the legislature that improper land use practices have caused serious soil erosion. The preservation of farm land is essential to the health, safety, and welfare of the public. Soil erosion has caused the accumulation of silt and sedimentation in streams, reservoirs, and other bodies of water. By removing valuable topsoil, erosive forces have sharply decreased the productivity of land. In addition, the loss of the absorptive topsoil has perpetuated conditions conducive to flooding. The accumulation of silt and sediments on lake and river beds has destroyed the flood supply of fish and has interfered with navigation. To combat erosion, soil conservation districts shall be established. Any twenty-five persons owning land lying within the territorial limits of a proposed district may petition the state soil conservation committee to organize a district. Once organized, the district has power to investigate and to take preventive or improvement measures. The district shall also have numerous other comprehensive powers to allow it to deal effectively with this serious problem. Cities and counties are authorized to contract with a district for construction of flood control projects and to use the projects as recreational areas. (Stewart-Fla)
W69-07609

CONDEMNATION BY COUNTIES FOR WATERSHEDS.
Ga Code Ann secs 36-1401 through 36-1405 (Supp 1968).

Descriptors: *Georgia, *Eminent domain, *Watershed management, *Flood control, Legislation, Condemnation, Local governments, Watersheds (Basins), Small watersheds, Flood protection, Easements, Recreation facilities, Legal aspects.
Identifiers: Improvement works, Watershed projects.

In order to create small watershed projects and to provide for flood control, each county is authorized to exercise the power of eminent domain. This power is exercisable for the purpose of creating recreational facilities developed in connection with any watershed project. In addition, the power of eminent domain may be used to acquire ways of ingress and egress to any such project. The procedures to be followed in condemning land for the enumerated purposes are to conform with those provided by existing eminent domain statutes. (Childs-Fla)
W69-07618

PROTECTION OF NAVIGABLE WATERS - INVESTIGATIONS CONCERNING EROSION OF SHORES OF COASTAL AND LAKE WATERS.

33 USCA secs 426, 426-1, 426-2, 426-3, (1967) Supp.

Descriptors: *Erosion control, *Federal government, *Legislation, *Navigable water, Erosion, Coasts, State jurisdiction, Ocean currents, Beach erosion, Waves (Water), Administrative agencies, Coordination, Lakes, Lake shores, Federal-state water rights conflicts, Water resources development, Navigable rivers, Federal jurisdiction.
Identifiers: Coastal Engineering Research Center, Corps of Engineers, Secretary of the Army.

The Chief of Engineers of the United States Army, under the direction of the Secretary of the Army, is authorized to cause investigations to be made in cooperation with the appropriate agencies of the various states on the Atlantic, Pacific, and Gulf coasts, the Great Lakes, and the states of Alaska and Hawaii, the Commonwealth of Puerto Rico, and the possessions of the United States. Such investigations are made to aid in devising effective means of preventing erosion of the shores of coastal and lake waters by waves and currents. The Beach Erosion Board previously provided for is abolished by Public Law 88-172. The investigations shall be established under the Chief of Engineers, a Coastal Engineering Research Center which shall be vested with all the functions of the Beach Erosion Board including the authority to make general investigations. All functions of the Beach Erosion Board pertaining to the review of reports of investigations made concerning erosion, are transferred to the Board of Engineers for Rivers and Harbors. (Smith-Fla)
W69-07655

SOIL CONSERVATION.

Minn Stat Ann secs 40.01-40.03 (1963).

Descriptors: *Minnesota, *Soil conservation, *Soil erosion, Legislation, State governments, Federal government, Floods, Diseases, Droughts, Administration, Administrative agencies, Standards, Legal aspects.

It is the declared public policy of the state to prevent soil erosion, floods, water shortages, disease, and general suffering resulting therefrom. In line with this policy a soil and water conservation commission is established, consisting of nine members, five of whom must be operating farmers. The commission shall have the powers and duties to assist and supervise soil conservation districts, to coordinate the programs of the several districts, to secure the cooperation of the federal government, to disseminate soil conservation information, and to subdivide or consolidate conservation districts. Provisions are set out for the establishment of soil conservation districts by petition of landowners. (Kahle-Fla)

W69-07676

WATERSHED IMPROVEMENT DISTRICTS.
W Va Code Ann secs 19-21B-1 through 19-21B-13 (1966).

Descriptors: *West Virginia, *Watershed management, *Watersheds (Basins), Water users, Soil conservation, Legislation, Public health, Public benefits, Local governments, State governments, Water resources, Water resources development, Water utilization.
Identifiers: Soil conservation districts, Watershed improvement district.

Landowners within a soil conservation district may petition the supervisors of the district for the establishment of a watershed improvement district. Requirements for the petition are set out. The supervisors shall hold a public hearing and establish a watershed improvement district whenever conservation, development or utilization of water will be promoted by the construction of improvements and where there is a need in the interest of public health, safety or welfare for the organization of such a district. When established the district constitutes a governmental division of the state and a public body corporate with all the powers of the soil conservation district in which it is situated. The supervisors of the soil conservation district shall be the governing body of the watershed improvement district and may appoint three landowners in the district as trustees to carry out the business of the watershed improvement district. The district may be discontinued after five years by petition made in same manner as was necessary for its creation. (Kahle-Fla)
W69-07688

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

EVALUATION OF NITRIFICATION IN STREAMS,
Michigan Univ., Ann Arbor. Dept. of Environmental Health.
Chester T. Wezernak, and John J. Gannon.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA5, Pap 6159, pp 883-895, Oct 1968. 13 p, 5 fig, 7 tab, 18 ref, append. PHS Proj No 70. Grant NIH I Sol FR 5447-05 GRS and WP-15 (FWPCA).

Descriptors: *Nitrification, *Chemical oxygen demand, *Streams, *Michigan, Sampling, Chemical analysis, Ammonia, Nitrates, Nitrogen compounds, Inorganic compounds.
Identifiers: *Clinton River (Mich).

A simplified procedure for evaluating nitrification progression in a stream by sampling and analyses is given. Data are presented for the Clinton River between Pontiac and Rochester, Mich, which show rapid inorganic nitrogen oxidation in this section of the river. Graphical and analytical techniques for evaluating nitrification parameters and progression are described. (Knapp-USGS)
W69-07521

5B. Sources of Pollution

PROBLEMS OF POLLUTION OF IRRIGATION WATERS IN ARID REGIONS,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering; and Federal Water Pollution Control Administration, Ada, Okla.
H. B. Peterson, A. A. Bishop, J. P. Law, and Robert S. Kerr.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 21 p, 3 fig, 27 ref.

Descriptors: *Water quality, *Water pollution sources, *Return flow, *Irrigation effects, Arid lands, Sediments, Saline water, Drainage effects, Consumptive use, Reuse, Disposal, Runways, Fertilizers, Pesticide residues, Impaired water quality, Radioactive wastes, DDT, Animal wastes (Wildlife), Dissolved solids, Heavy metals, Industrial wastes, Farm wastes, Municipal wastes, Nematodes, Nitrates, Organic wastes, Phosphates, Pollutants.

Sources and types of water pollution, both natural and man related, and their relation to irrigation agriculture in afferent and efferent roles are discussed. Sources of natural pollution described are salts, sediments, animal wastes, plant nutrients, and toxic elements. Sources of agricultural pollution detailed are concentration of salts under irrigation, plant nutrients from fertilizers (nitrogen and phosphorus), wastes from animal-feeding operations and pesticides (directly and as break-down compounds). Pollutants of industrial waste of particular concern to irrigated agriculture include total dissolved solids, sodium, chlorides, boron, heavy metals, pesticides, radio-activity and numerous organics. Water quality needs of irrigated agriculture are briefly considered and probable changes in quality as a result of irrigation are detailed. Several methods to regulate pollutants in return flow are presented, as are ways of reducing the salt loading effect of waters. Several possible benefits of irrigation treatment of water are listed. (Sherbrooke-Ariz)
W69-07355

DEGRADATION OF GAMMA-BHC IN SIMULATED LAKE IMPOUNDMENTS AS AFFECTED BY AERATION,
Wisconsin Univ., Madison. Dept. of Soils.
For primary bibliographic entry see Field 05G.
W69-07364

ORGANIC PRODUCTION IN A TROPICAL ESTUARY,
National Inst. of Oceanography, Cochin (India). Biological Oceanographic Div.
S. Z. Qasim, S. Wellershaus, P. M. A. Bhattathiri, and S. A. H. Abidi.
Proc Indian Acad Sci, Vol 69, No 2, Sect B, pp 51-94, Feb 1969. 44 p, 11 fig, 8 tab, 69 ref.

Descriptors: *Organic matter, *Productivity, *Tropical regions, *Estuarine environment, Carbon, Radioisotopes, Photosynthesis, Water temperature, Seasonal, Pollutant identification, Pollutants, Chlorophyll, Nutrients, Zooplankton.
Identifiers: *India, Cochin backwater estuary, Organic production, Tropical estuary.

Daily and seasonal rates of primary production in tropical estuaries and their critical appraisal were investigated on the basis of observations recorded at four stations located in the upper reaches of the Cochin Backwater estuary, and several earlier publications. The article contains the following sections: (1) introduction; (2) procedure and methods; (3) the environment; (4) rate of photosynthesis; (5) incubation time and diurnal rhythm; (6) photosynthesis as a function of illumination; (7) gross and net production; (8) seasonal changes in production rates; (9) factors influencing organic production; (10) estimation of production from radiation and chlorophyll; (11) productivity in relation to particular matter; (12) annual production; (13) efficiency; and (14) productivity in relation to zooplankton. The study shows that in a highly turbid and polluted estuary the C-14 assimilation is nearer to net production and the diurnal rhythm in photosynthesis is associated with the increase and decrease in daily illumination. Seasonal changes in the production rates are not well marked and show only 3- to 4-fold increase in certain months. The study also shows that for most of the year, primary production seemed nonexistent at depths greater than about 4 m and temperature and nutrients are not limiting factors in the estuary. (Gabriel-USGS)
W69-07388

DETERGENTS AND GROUNDWATER SUPPLY (FRENCH),
CERH Montpellier (France). Dept. of Sciences.
R. Plegat, and C. Armangau.
Terres and Eaux, Rev Int de L' Hydraul, Vol 22, No 58, pp 19-28, Jan-Mar 1969. 10 p, 11 fig, 1 tab, 10 ref.

Descriptors: *Aquifers, *Water supply, *Detergents, Water table, Streamflow, Hydraulic models, Boreholes, Rivers, Water analysis, Water circulation, Tertiary period, Hydrodynamics, Wells, Hydrologic data, Geology, Sedimentary rocks, Sands, Gravels, Marls, Mapping, Topography, Pumping, Water storage, Pollutants.

Because the use of detergents is very common in the Lez Valley, the detection and localization of water circulation was made by analyzing the content of detergents in the water of streams and aquifers. By combining the chemical analysis of stream and borehole water samples with the hydraulic river data, the circulation of water from the river to the aquifers was well recognized. (Gabriel-USGS)
W69-07390

OXYGEN DYNAMICS AND ECONOMIC GROWTH IN THE MILLSTONE RIVER,
Rutgers - The State Univ., New Brunswick, N. J.
William Whipple, Jr., and M. Marcus.
American Society of Mechanical Engineers 69-PID-8. Presented at ASME-AIChE Joint Conference on Stream Pollution and Abatement, June 10-12, 1969. 9 p, 8 fig, 5 tab.

Descriptors: *Organic loading, *Water pollution source, *Biochemical oxygen demand, Oxygen sag, Economics, Economic prediction, Water pollution effects, Stream pollution, Water quality.
Identifiers: *Oxygen dynamics, *Unrecorded organic loading, Unrecorded pollution, BOD concentration, BOD loading.

The Millstone River is a small stream used for water supply purposes in a rapidly urbanizing area of Northern New Jersey. A study of its organic pollution and biochemical oxygen demand was made in order to correlate the gross man-made waste load with growth of population and of industry in the area. This study has been successful in estimating the organic loading of the river and its principal tributaries, over an eleven year period, and in computing how much of a pollution load must have been placed in the water in various areas in order to account for the pollution remaining downstream. It was shown that gross pollution load, including recorded waste loads removed by waste treatment plants increased more than proportionately to either population growth or manufacturing activity. The most astonishing finding was that the organic loading due to recorded treatment plants effluents was only about half of the apparently man-made organic loading from other sources. This finding has very serious implications from the viewpoint of a water pollution control program depending solely upon treatment of recorded effluents. (Whipple-Rutgers)
W69-07445

WATER POLLUTION ASPECTS OF URBAN RUNOFF; THE CAUSES AND REMEDIES OF WATER POLLUTION FROM SURFACE DRAINAGE OF URBAN AREAS.
American Public Works Association, Chicago, Ill. Research Foundation.

FWPCA Publication No WP-20-15, January, 1969. 272 p, 32 tab, 12 fig, 26 ref, 6 append. WA-66-23 (FWPCA). APWA Research Project No 120.

Descriptors: Sewers, Pesticides, Corrosion control, Economics, *Urbanization, Legislation.
Identifiers: *Environmental pollution, *Storm water pollution, *Urban drainage, Street refuse, Air pollution dustfall, Catch basins, Street sweepers efficiency, *Storm sewers, Sewer solids, Combined sewers, Salt-ice control, Corrosion inhibitors, Guideliners, Roof runoff.

The environmental pollution factors and their potential pollutional effects resulting from the water-wastes interfacial contracts during precipitation and runoff have been analysed based upon collected field data and theoretical calculations. The urface urban environment factors studied included, street refuse and litter, catch basins, environmentally used chemicals, contributions from air pollution and its control, and sewer solids deposition. It was found that street refuse could present a significant pollution load. It is estimated that a pollution load (measured in terms of BOD) of (a) one percent of the total raw sewage or five percent of the total secondary treatment effluent in terms of average daily load, and (b) 160 percent of the raw sewage and 800 percent of the secondary effluent load, expressed in terms of the shock pollution load on the receiving body of water results from the dust/dirt fraction of street litter. Findings and Recommendations are presented in summary form. Raw data collected, survey questionnaires, and a comprehensive set of 'typical' ordinances governing a wide sampling of possible sources of urban storm water pollution are compiled in the report.
W69-07453

FISH-KILL IN BOONE RESERVOIR - JULY 9-13, 1968.
Tennessee Valley Authority, Chattanooga.

Tenn Valley Authority, Dec 1968, 65 pp, 1 photo, 2 fig, 4 tab, 3 append, 1 ref.

Descriptors: Tennessee Valley Authority, Tennessee River, *Fishkill, Water pollution, *Water pollution sources, Water pollution effects, Water chemistry, Environmental effects, *Pollutant identification, Bioassay, *Chemical wastes, Pesticide residues.
Identifiers: Watauga River, Boone Reservoir.

During the 5-day period July 9 through 13, 1968, more than 500,000 fish were killed in the Watauga arm of Boone Reservoir in northeast Tennessee. The fish were killed by a toxic compound of residual mercury that leaked out of a 55-gallon steel drum. Many such drums are used for flotation purposes at boat docks, and many have become derelicts. The cause of the kill was difficult to track down and it was not until all the more common causes of fish-kill were eliminated that a toxic material and its source were pinpointed. Considerable scientific detective work was necessary to trace the toxicant, and much laboratory and field work was involved. Several laboratories and agencies cooperated in the investigation. The report documents the procedures followed in establishing the cause of the fish-kill. (Ingram-TVA)
W69-07461

ABATEMENT OF POLLUTION FROM MINE WASTEWATERS,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
J. W. Schmidt, and K. Conn.
Can Mining J, Vol 90, No 6, pp 54-60, June 1969. 7 p, 4 fig, 7 tab, 9 ref.

Descriptors: *Pollution abatement, *Waste water (Pollution), *Ponds, *Waste water treatment, Chemical analysis, Acidic water, Mine water, Mineral industry, Pyrite, Copper, Calcium, Iron, Water analysis, Organic compounds, Oxygen, Sodium, Potassium, Bacteria.
Identifiers: Mine wastewater pollution abatement.

This paper reports on a study of acid generation within the tailings pond system and effluent receiving stream of a base metal mine located in the northeastern part of New Brunswick, Canada. The mine under investigation contains a sulphide ore body and the effluent from the mine is discharged to the South Little River. The study shows that the mechanism of acid generation is due to the following: (1) the formation and subsequent precipitation of calcium carbonate; (2) the chemical oxidation of partially oxidized sulphur compounds; and (3) the precipitation of sulphite. Within the receiving stream the generation of acid is caused by the continuing chemical oxidation of sulphur compounds and, predominantly, by the bacteriological utilization of the thionates to produce sulphuric acid. Some possible treatment of wastes is also given. (Gabriel-USGS)
W69-07490

EVALUATION OF NITRIFICATION IN STREAMS,
Michigan Univ., Ann Arbor. Dept. of Environmental Health.
For primary bibliographic entry see Field 05A.
W69-07521

POLLUTION FORECASTING IN AN ESTUARY (JAPANESE),
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
Akinori Sugiki.
J Fac Eng, Tokyo Univ, Ser A, Annu Rep No 6, pp 12-13, 1968. 2 p, 5 fig, 2 ref.

Descriptors: *Pollutant identification, *Pollutants, *Estuaries, Estuarine environment, Oxygen, Oxygenation, Mathematical studies, Mixing, Aeration, Bottom sediments, Nitrogen compounds, Sulfur compounds.
Identifiers: Estuary pollution.

This study was undertaken for the purpose of elucidating the mechanism of estuary pollution, using the Sumida estuary as an example and analyzing the factors affecting the oxygen balance of polluted waters. The study shows that a mixing theory developed for the Thames river estuary is the most reliable for forecasting the conditions of pollution in a strongly mixed estuary. The study also gives a clear understanding of deoxygenation, reaeration and oxygen consumption by bottom deposits, and other estuary parameters in the process of estuary pollution. The 1975 and 1985 pollutional loads of the sumida estuary were estimated and presented in this investigation. (Gabriel-USGS)
W69-07530

WASTE WATER RECHARGE AND DISPERSION IN POROUS MEDIA,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
John Austin Hoopes, and Donald R. F. Harleman.
Mass Inst Tech Hydrodynamics Lab Rep No 75, June 1965. 166 p, 40 fig, 3 tab, 120 ref. PHS Grant No WP-347.

Descriptors: *Path of pollutants, *Groundwater movement, *Diffusion, *Dispersion, *Mathematical models, Model studies, Hydraulic models, Tracers, Injection wells, Artificial recharge, Convection, Mixing, Flow, Porous media.
Identifiers: Disposal wells.

The effects of dispersion and diffusion of wastewater solutes in aquifers near the injection wells are incorporated in a mass conservation equation. Solutions are derived to predict the tracer distributions resulting from various recharge and disposal operations. For uniform flow, the longitudinal and lateral dispersion coefficients are related to the seepage velocity, particle size, and media structure. These coefficients are determined from experimental measurements of the distribution of a dilute salt tracer in flow through a sand column. Convection and dispersion determine the tracer distribution near the well. At larger distances from the well, molecular diffusion and convection alone are important. With a pair of wells, one recharging tracer fluid and the other pumping the mixture of tracer and native groundwater, the solution for the tracer distribution indicates that lateral dispersion has a negligible influence on the tracer distribution, except very near the line joining the two wells. Molecular diffusion is also shown to be insignificant, except for small flow rates and large well-spacings. Longitudinal dispersion determines the shape of the tracer distribution within the media, whereas convection dominates the tracer distribution at the pumping well, except for short times. (Knapp-USGS)
W69-07554

NAVIGATION AND NAVIGABLE WATERS.
For primary bibliographic entry see Field 05G.
W69-07660

POLLUTION OF STREAMS.
For primary bibliographic entry see Field 05G.
W69-07697

5C. Effects of Pollution

EUTROPHICATION STUDIES IN A SHALLOW INLET ON VANCOUVER ISLAND,
Fisheries Research Board, Nanaimo (British Columbia). Biological Station.
Michael Waldichuk.
J Water Pollut Contr Federation, Vol 41, No 5, Part 1, pp 745-764, May 1969. 15 fig, 2 tab, 14 ref.

Descriptors: *Eutrophication, *Estuaries, *Nutrients, Municipal wastes, Industrial wastes, Salinity, Water temperature, Water pollution, Water pollution effects, Dissolved oxygen, Phosphates, Nitrates, Ecology.
Identifiers: *Canada, Vancouver Island, Juan de Fuca Strait.

Thirteen sampling stations were established in the Victoria Harbor, B. C., Canada, area to establish the gradient of temperature, salinity, dissolved oxygen, pH, phosphate, nitrate, ammonia, soluble carbon, and chlorophyll from the relatively uncontaminated Juan de Fuca Strait to the heavily polluted Portage Inlet and tributary waters. While the input of nutrients into the inlet is not large, the volume of the system is so small and flushing so poor that nutrients become concentrated, particularly during the summer months when phosphates and nitrates are absorbed by the plankton and deposited on the bottom. From all practical points of view, there is little solution to this enrichment problem short of removal of all nutrient sources. The plan envisaged by the Provincial Government to cut a canal through the Thetis Cove to Portage Inlet, and by a system of locks to provide a means of rapidly flushing the system, seems to be a good solution to the eutrophication problem. However, the ecology will be modified considerably and the temperature in Portage Inlet during the summer months will be much reduced, making it less suitable for bathing. (Knapp-USGS)
W69-07361

POTENTIAL POLLUTIONAL EFFECTS IN DEEP LAKES,
Environmental Control Administration, Cincinnati, Ohio.
Henning Eklund.
J Water Pollut Contr Federation, Vol 41, No 5, Part 2, pp R155-R159, May 1969. 5 p, 3 fig, 9 ref.

Descriptors: *Lakes, *Thermal stratification, Dissolved oxygen, Water pollution, Nutrients, Biochemical oxygen demand, Epilimnion, Hypolimnion, Thermocline, Water temperature, Turnovers, Water circulation.
Identifiers: Deep lakes.

The annual circulation of deep lakes is not as simple as that for shallow lakes. The hypolimnion of a deep lake may contain an inherent stability independent of the stability associated with a thermocline. It appears that deep lakes do not necessarily turn over every year. If this is true and the dissolved oxygen in the hypolimnion becomes depleted it might be several years before the oxygen would be replenished through complete overturn of the lake. Directly contributed biochemical-oxygen-demanding material, plankton that develop from nutrient buildup, and biochemical-oxygen-de-

manding material released by anaerobic decomposition conceivably cause this oxygen depletion which might last for an extended period. (Knapp-USGS)
W69-07363

THE ROLE OF ALGAE IN THE BIOLOGICAL TREATMENT OF WATER (FRENCH),
IRCHA (France). Microbiology Service.
R. Cabridenc, and H. Lepailleur.
Terres and Eaux, Rev Int de L'Hydraul, Vol 22, No 58, pp 12-18, Jan-Mar 1969. 7 p, 7 fig, 1 tab, 25 ref.

Descriptors: *Algae, *Biological treatment, *Water treatment, *Pollutant identification, *Pollutant abatement, Effluents, Streamflow, Desalination, Tertiary treatment, Lagoons, Oxygenation, Absorption, Ecology, Water purification, Carbon, Bicarbonates, Photosynthesis, Nutrients, Microbiology.
Identifiers: Water purification by algae.

The role of algae, as a desalination and purification agent, was investigated on the basis of earlier publications and recent experiments conducted by the authors. The study shows that oxygen liberated in the course of photosynthesis leads to the oxygenation of aquatic media and considerable reduction of pathogenic germs. The study also shows that there is competition between algae and other microorganisms; however, in the present state of knowledge, the problem of interaction due to the production by algae of inhibiting or activating substances is still not clearly understood. The degree of purification of water by the lagooning process, in many cases is equivalent to, or greater than that obtained by other biological processes. (Gabriel-USGS)
W69-07389

REAERATION MEASUREMENTS IN A EUTROPHIC STREAM,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05G.
W69-07420

THE ACTINOMYCETES,
Rutgers - The State Univ., New Brunswick, N. J. Inst. of Microbiology.
Hubert Lechevalier.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, Inc, New York, pp 230-253, 1964. 10 fig, 1 tab, 43 ref, disc.

Descriptors: *Classification, *Actinomycetes, Bacteria, Fungi, Microorganisms, Spores, Viruses, Antibiotics (Pesticides), Anaerobic conditions, Cultures, Isolation, Sampling, Oxygen, Soil microorganisms, Mud, Temperature, Saline water, Electron microscopy, Bacteriophage, Hydrogen sulfide, Rubber, Foods, Biodegradation, Farm wastes.
Identifiers: Actinophages, Gram-positive bacteria, Lysozyme, Media, Chemical composition, Morphology, Cellular size, Sporangia, Hyphae, Mycelium, Chemical content, Bright field microscopy, Cell wall, Actinomycoses, Contaminants, Nuclear membrane, Termites, Pericarditis, Leprosy, Pneumonia, Nocardiosis, Farcy, Tumefactions, Potato scab, Wool, Leather, Diaminopimelic acid isomer.

Actinomycetes produce most antibiotics. Electron microscopic observations established them taxononically as bacteria. Cellular size, cellular contents, and absence of membrane around the nuclear material show striking relationships. Actinomycetes are hosts to phages of their own that are similar to bacteriophages both in action and in morphology. They are sensitive to strictly antibacterial antibiotics and resistant to strictly antifungal antibiotics. The mucoid nature of their cell walls is similar to certain Gram-positive bacteria. Enzymatic studies clearly differentiate the walls of actinomycetes from those of fungi. There are strictly anaerobic forms among actinomycetes and bacteria but not among fungi. Isolation of pure cultures was best made on lean media not favorable to true bacteria. A morphological distinction depends upon the growth of spores on aerial or substrate mycelium. Since actinomycetes are bacteria with fungal morphology, methods of morphological studies are those of fungi. The key to the genera is morphologic, but the chemical composition of the cell walls is also a deciding factor. Natural distribution of the ten genera is wide. Soil is their greatest reservoir. They are salt-tolerant and found in marine microflora. Fish pick up from them and store a substance with undesirable tastes and odors. For main entry see W69-07423. (Jones-Wisc)
W69-07424

ARTHROBACTER,
Agricultural Univ., Wageningen (Netherlands). Lab. of Microbiology.
E. G. Mulder.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 254-279, 1964. 28 fig, 5 tab, 37 ref, disc.

Descriptors: *Classification, *Microorganisms, *Fermentation, *Water purification, *Microbiology, *Aerobic bacteria, Sludge, Plant growth, Industries, Acidicity, Temperature, Chemical properties, Carbohydrates, Nitrogen compounds, Vitamins, Yeasts, Mycobacterium, Amino acids, Degradation (Decomposition), Cellulose, Herbicides, Lignins, Phenolds, Desiccants.
Identifiers: *Morphology, *Physiology, *Pleomorphism, *Decompose, Cheese, Cystites, Biotin, Cellulomonas biazotea, Microbacterium, Brevibacterium linens, Corynebacteriaceae, Nocardia, Polysaccharides, Micrococcus.

Microorganisms of the Arthrobacter type are important in soil, water, and industrial microbiology. In coccoid state, they are part of autochthonous flora and in rod form, of zymogenous flora. Habitat includes activated sludge, certain cheese, and plants. Certain strains attack compounds which normally are not attacked by microorganisms; some produce compounds which have commercial value. In the coccus stage resistant to prolonged desiccation even beyond 10 months, soil arthrobacters synthesize polysaccharides; excrete amino acids; give active phage suspension; and decompose cellulose, lignin, phenols and certain herbicides. Strains from activated sludge strongly decompose carbohydrates. The various Arthrobacter strains are morphologically similar but physiologically different. Isolation and identification depends on chemistry of media, temperature, and acidity. Nutrients and age affect morphology. Aerobic, pleomorphic characteristics are evident. Diverse Arthrobacter strains are morphologically similar to Brevibacterium linens, Cellulomonas biazotea, and Mycobacterium phlei. Gram-negative or Gram-variable in rod stage in soil, arthrobacters shifted to Gram-variable in coccoid form; reverse was also found. Strains from activated sludge, except those with phenol-decomposing capacity, reacted like soil strains. Utilization of nitrogen compounds and vitamin requirements affect classification. Arthrobacter from soil and sludge can utilize inorganic nitrogen either without vitamins or with biotin. For main entry see W69-07423. (Jones-Wisc)
W69-07425

HYDROCARBON STRUCTURE: ITS EFFECT ON BACTERIAL UTILIZATION OF ALKANES,
Iowa Univ., Iowa City. Dept. of Microbiology.
Eva J. McKenna, and R. E. Kallio.
Proc Rudolfs Res Conf Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 1-14, 1964. 8 fig, 4 ref, disc.

Descriptors: *Molecular structure, *Bacteria, *Microorganisms, *Yeasts, *Fungi, Oxidation, Manometers, Enzymes, Detergents, Biodegradation.
Identifiers: Hydrocarbons, Nocardia corallina, Micrococcus, Pseudomonas, Mycobacterium, Isomerization, Alkanes, Utilization, Paraffins.

Structures of hydrocarbons, added to miner media, were tested for microbial growth sustainin properties. Studies with hexadecane isomers raise the questions of the effect of more than one methy substituent on a normal alkane chain and the effe of larger hydrocarbon substitutions on an alkan chain. Prestane, squalene, and a few methy branched hydrocarbons support growth. Whe more than one methyl group appears on a carbo atom, particularly if the carbon atom is the penult mate carbon, the resulting hydrocarbon is extreme ly resistant to microbial degradation. Groups large than methyl (propyl or phenyl) appear to prever utilization. Current concensus in the detergent in dustry indicates alkyl benzene sulfonate degrada tion begins at the alkyl portion of the molecule. Si strains of alkane-utilizing micrococci were teste for their ability to grow at the expense of a series o phenyl alkanes. All test organisms utilize 1-pheny dodecane. Utilization of the phenyl alkan decreases as the phenyl is moved along the skeleto to the carbon-six position. Length of the total alky chain is not the sole criterions of availability. A number of alkanes are oxidized by organism without serving as carbon sources, raising th question of true oxidation versus stimulation of au torespiration. For main entry see W69-0742 (Jones-Wisc)
W69-07426

MICROBIOLOGY OF PESTICIDES AND RE LATED HYDROCARBONS,
Cornell Univ., Ithaca, N. Y. Lab. of So Microbiology.
Martin Alexander.
Proc Rudolfs Res Conf Rutgers Univ, New Brun swick, NJ. Principles and Applications in Aquati Microbiology, Heukelekian, H and Dondero, No man C (eds), John Wiley and Sons, New York, p 15-42, 1964. 10 fig, 7 tab, 25 ref, append, disc.

Descriptors: *Pesticides, *Herbicides, *Fungicide *Insecticides, *Microbiology, *Chemical *Molecular structure, *Decomposing organi matter, Ecology, Biochemistry, Soils, Toxicity Aquatic microbiology, Public health, Physiologici ecology, Detergents, Industries, Pollutant Biodegradation, Phenolic pesticides, Habitat Chromatography, Bioassay, Bacteria, Fungi, Ac tionomycetes, Spectrophotometry, Ultraviole radiation.
Identifiers: Hydrocarbons, Inactivation, Destruc tion, Nocardia, Flavorbacterium, Pseudomonas, In termediates, Achromobacter, Trichoderm Arthrobacter, Alcaligenes, Corynebacterium.

Pesticides may be leached, decomposed, ina tivated by colloidal materials, dissipated whe volatile, or degraded microbiologically. Losses a recorded by gas chromatograph, bioassay, and ce tain indirect tests, relying upon properties peculi to the compound. Mainly bacteria, few fungi an actinomycetes, affect herbicide decomposition Structures of 2,4-D and 2,4,5-trichlorophenox yacetic acid were studied by spectrophotometri methods to establish time of aromatic rin cleavage, by plant bioassay techniques, and by pur cultures. Ultraviolet absorption disappears wit substance degradation. No compound, having o its aromatic nucleus a chlorine in positions 3 or 5, transformed sufficiently to cause significant loss ultraviolet absorption. Point of linkage of the fat acid side chain regulates susceptibility of the aro matic portion of the molecule to microbial attac The only phenols persisting more than ten week had at least one halogen in positions 3 or Mechanism of microbial decomposition of the in termediates is little known. Degradation of phenox y compounds, having an even number of carbons i the sidechain, proceeds via the butyrate derivativ and, with an odd number of carbons, via th

propionate and pentanoate derivatives. Mechanisms for metabolism of phenoxyalkanoic acid herbicides are beta-oxidation of the aliphatic moiety and cleavage of the ether linkage. For main entry see W69-07423. (Jones-Wisc)
W69-07427

MICROBIAL TRANSFORMATIONS OF MINERALS,
Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Biology.
Henry L. Ehrlich.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 43-60, 1964. 5 fig, 43 ref, disc.

Descriptors: *Microbiology, *Mineralogy, *Microorganisms, *Water pollution, *Water purification, *Bacteria, *Enzymes, Corrosion, Oxidation, Reduction (Chemical), Hydrolysis, Chelation, Fungi, Algae, Protozoa, Lichens, Plants, Diatoms, Coral, Mollusks, Mine acids, Coal mines, Acidity, Pyrite, Sulfur compounds, Molybdenum, Rotifers, Ecosystems, Photosynthesis, Environment, Aqueous solutions, Terrestrial habitats, Iron compounds, Manganese, Trophic level.
Identifiers: *Mineral transformation, Metazoa, Radiolaria, Foraminifera, Thiobacillus-Ferrobacillus, Thiobacillus denitrificans, W Virginia, Pennsylvania, Marcasite, Chalcocite, Covellite, Sphalerite, Millerite, Orpiment, Tetrahedrite, Bornite, Chalcopyrite, Chemosynthesis, Concretions, Arthrobacter, Pyrophosphate, Orthophosphate, Dismutation, Tannins.

Biological processes of some microorganisms, especially bacteria, cause transformation of mineral matter. Involved are direct enzymic interaction--oxidations and reductions, hydrolysis, chelate destruction--and, indirect nonenzymic interaction--insoluble matter corrosion by metabolically produced acid, inorganic ions precipitation by other, metabolically-produced inorganic ions, adsorption onto cell surfaces, and metal chelate formation. The bacterial chemosynthetic autotrophs use mineral oxidation as a chemical energy source, reducing power for the synthesis of organic matter from carbon dioxide and water. Oxidation of metal sulfides and of Fe (II) to Fe (III) takes place. Bacterial photosynthetic autotrophs use mineral oxidation merely as a source of reducing power in carbon dioxide assimilation, depending on radiation for energy. The enzyme, inorganic pyrophosphatase, present in bacteria, is probably hydrolyzed to orthophosphate. Pyrophosphate can complex Mn (III) and hydrolysis could lead to the ion precipitation. Enzymic breakdown of the chelating agent by bacteria may result in precipitating the metal ions. The nonenzymic interactions depend on end products of metabolism, acids which act on acid-soluble minerals. Some precipitations may form amorphous or crystalline agglomerates. In adsorption, iron and manganese oxides possibly form into encrustations. In chelation, a metabolically produced organic compound may complex one or another metal ion. For main entry see W69-07423. (Jones-Wisc)
W69-07428

SOME OBSERVATIONS OF THE SPHAEROTILUS-LEPTOTHRIX GROUP,
Illinois Univ., Urbana. Lab. of Microbiology.
E. G. Mulder.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 98-112, 1964. 21 fig, 6 ref, disc.

Descriptors: *Classification, *Bacteria, Microorganism, Enzymes, Oxidation, Iron, Manganese, Cultures, Nitrogen compounds, Carbon, Vitamins, Ditches, Soil water, Sewage bacteria, Waste water (Pollution), Activated sludge, Habitats.
Identifiers: *Chlamydobacteria, *Morphology, *Physiology, Media, Poly-beta-hydroxybutric acid, Sphaerotilus natans, Leptothrix ochracea, Leptothrix lopholea, Leptothrix pseudo-ochracea n sp, Leptothrix cholodnii n sp, Leptothrix discophora, Sheaths.

Morphological and physiological characters of strains of Sphaerotilus-Leptothrix bacteria were studied in slowly-running sterile soil extract containing ferrous iron, on agar media, and in cultures with or without manganese salts. The effect of nitrogenous and carbon compounds and of vitamins was tested. Isolated from activated sludge, waste water, and running ditch water containing iron precipitates, all members of the group can be grown in synthetic media containing glucose, aspartic or glutamic acids, and vitamin B-12. All oxidize manganous salts, except Type I. Their cells contain globules of poly-beta-hydroxybutic acid. Type I, Sphaerotilus natans, with long sheaths, differs from Leptothrix ochracea. Nutrients affect presence of sheaths and smoothness of colony edges. Types II and III have large cells resembling S natans, but differ in utilization of organic nutrients. Type II, Leptothrix lopholea, forms fungus-like flocks of short trichomes, radiating from a common holdfast in liquid media. Type III, Leptothrix pseudo-ochracea n sp, resembles Leptothrix ochracea with shorter and frequently empty sheaths. Type IV, Leptothrix cholodnii n sp, forms filamentous colonies, large, white and smooth, or black-brown, dependent on the media. Type V, Leptothrix discophora, has smaller cells than Type IV, smaller colonies than the other types, and are filamentous or smooth. For main entry see W69-07423. (Jones-Wisc)
W69-07429

RIVER BACTERIOLOGY AND THE ROLE OF BACTERIA IN SELF-PURIFICATION OF RIVERS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
Karl Wuhrmann.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 167-192, 1964. 5 fig, 2 tab, 7 ref, disc.

Descriptors: *Bacteria, *Rivers, *Self-purification, *Currents (Water), Ecology, Pollutants, Recreation, Water supply, Oxygen, Habitats, Biomass, Soil microbiology, Fungi, Flow, Velocity, Temperature, Plants, Groundwater, Sewage, Mosses, Diatoms, Phenols, Biochemical oxygen demand, Ammonium compounds, Nitrogen compounds, Alkalinity, Degradation (Decomposition), Metabolism, Hydrography, Oxygen sag, Chemical analysis, Rates, Parametric hydrology.
Identifiers: Glucose, Sphaerotilus natans, Beggiatoa, Biotopes, River Nile, Soil water, Fontinalis, Amblystegium, Hormidium, Thiobacillus, Leptothrix, Fusarium, Leptomitus lacteus, Hydrocarbons, Zoogloea, Carchesium polyp, Vorticella sp, Synedra ulna, Nitzschia palea, Zurich, Elimination, Autotrophs, Heterotrophs, Time.

Water current is important synecologically but has no autoecological significance to bacteria in rivers. In two experimental rivers, with waters of different quality, the proportion of the freely suspended bacteria was less than 1% that of the epiphytic. A third large group of bacteria, the epibenthic, is especially numerous in polluted streams. Majority of bacteria in rivers are introduced by washings from soil or with sewage. The hygienic types are not important ecologically. Unique mass developments of certain bacteria or fungi observed in streams have no parallel in soil microbiology. It is doubtful whether flow velocity exerts direct physiological influence essential for growth. Self-purification, defined as removal of organic compounds from water by the metabolism of microorganisms, is estimated quantitatively on the results of recognized analytical procedures for individual chemical compounds, or, for a known group of compounds. Biochemical oxygen demand values do not fulfill this requirement. Model rivers controlling ecological factors were assayed. Self-purification rate is highly dependent on absolute quantity of biomass in intimate contact with flowing water. The simultaneous quantitative and qualitative estimate of acting microorganisms and qualitative measure of self-purification of defined chemical compounds are significant. For main entry see W69-07423. (Jones-Wisc)
W69-07431

THE ECOLOGICAL ROLE OF PHOSPHORUS IN WATERS WITH SPECIAL REFERENCE TO MICROORGANISMS,
Dalhousie Univ., Halifax, Nova Scotia. Dept. of Biology.
John E. Phillips.
Proc Rudolfs Res Conf, Rutgers Univ, New Brunswick, NJ. Principles and Applications in Aquatic Microbiology, Heukelekian, H and Dondero, Norman C (eds), John Wiley and Sons, New York, pp 61-81, 1964. 13 fig, 14 ref, disc.

Descriptors: *Phosphorus, *Phosphorus radioisotopes, *Ecology, *Water, *Microorganisms, *Bacteria, Phytoplankton, Zooplankton, Plants, Sediments, Mud-water interfaces, Radioactivity, Cores, Invertebrates, Sea water, Phosphorus compounds, Lakes, Chromatography, Mud, Temperature, Light, Density.
Identifiers: Antibiotics, Terramycin, Tetracycline, Eriocaulon, Sphagnum, Utricularia, Gammarus locusta (Marine), Halifax (NS), Nostoc, Fucus vesiculosus, Scanner.

Phosphorus level may limit the productivity of lakes and oceans. Microorganisms are important in the continual exchange of phosphorus between the water phase, the sediments, higher plants, and zooplankton. Water bacteria reduce the rate of exchange and hold more phosphorus in the water. Normal competition for phosphorus exists between the various solid phases. Rapid uptake of radiophosphorus by Gammarus in the presence of bacteria shows that higher invertebrates obtain their food by digestion of particulate matter rather than by direct absorption of dissolved inorganic or organic compounds, thus microorganisms play an essential role in making phosphorus available to zooplankton and hence to higher groups in the food chain. Conversion of dissolved inorgnic phosphate to dissolved organic phosphorus through the intermediate activity of bacteria is a reversible process. There is no direct reconversion of dissolved organic phosphorus to inorganic phosphate without intermediate incorporation into the bacteria. Preliminary integration of time relationship of the several phosphorus reactions which might occur in a lake or bay is warranted. On adding phosphate to water, the immediate reaction is the transfer through the bodies of unicellular suspended life forms. Time depends on temperature, light, cell density and nutrient availability. For main entry see W69-07423. (Jones-Wisc)
W69-07435

AMORPHOUS CLAY FRACTION OF SOILS AND ITS ADSORPTIVE PROPERTIES. A SELECTED BIBILOGRAPHY,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02K.
W69-07436

THE EXCHANGE OF DISSOLVED SUBSTANCES BETWEEN MUD AND WATER IN LAKES,
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 02H.
W69-07438

A MATHEMATICAL MODEL FOR THE CONTINUOUS CULTURE OF MICROORGANISMS UTILIZING INHIBITORY SUBSTRATES,
Clemson Univ., S.C. Environmental Systems Engineering.
For primary bibliographic entry see Field 05D.
W69-07439

PROBLEMS OF BIOLOGICAL OCEANOGRAPHY.
Akademiya Nauk URSR. Inst. of Biology of Southern Seas.

Available from Clearinghouse as AEC-tr-6940 at $3.00 in paper copy and $0.65 in microfiche. Transl Vopr Biookeanograffi Materialy II Mezhdunarodnoga Okeanogr Kongr 30 May-9 June 1966. Naukova Dumka, Kiev, 1967. US Atomic Energy Comm, Translation Series AEC-tr-6940. 94 pp, 13 fig, 18 tab, 99 ref.

Descriptors: *Conferences, *Oceanography, *Translations, Algae, Crustaceans, Benthos, Brine shrimp, Ecosystems, Fish, Phytoplankton, Plankton, Radioactivity, Radioactivity effects, Radioecology, Sorption, Water pollution effects, Water pollution sources.
Identifiers: *Biological oceanography, *Transactions, Black Sea, Contact zones, Artemia, Balanus, Desorption, Embryology, Energy transformations, Heterotrophy, Organic pollution, Marine organisms, Marine associations, Moscow, Petroleum pollution, Photosynthetic pigments, Production biology, Russia, Second International Oceanographic Congress, Hyponeuston.

Tropical coverage of 16 individual contributions are as follows: Planktonic ecosystems of the Black Sea; production rate of heterotrophs; transformation of substances and energy by amphibiontic crustacea in Black Sea; energy transformation by Artemia, seasonal dynamics of algal photosynthetic pigments in Black Sea; benthos development in Mediterranean basin; ecologico-geographic development of contact zones in southern seas; influence of petroleum products on phytoplankton of seas; influence of organic pollution on development of Balanus; marine radioecology and oceanography; radioecological significance of hyponeuston; effects of radioactivity on embryology of fishes; kinetics of accumulation and exchange of radioisotopes by marine algae; artificial radioactivity of marine organisms; distribution of radioactivity in marine organisms and associations; and sorption and desorption of radionuclides in bottoms of shallow seas. (Eichhorn-Wisc)
W69-07440

SYMPOSIUM ON RADIOECOLOGY.
Ecological Society of America; Atomic Energy Commission, Washington, D. C.; and Michigan Univ., Ann Arbor.

Available from Clearinghouse as CONF 670503 at $3.00 in paper copy and $0.65 in microfiche. Proc Second National Symposium on Radioecology, Nelson, Daniel J. and Evans, Francis C (eds), Ann Arbor, Mich, 1967. 774 p, 303 fig, 207 tab, 1364 ref.

Descriptors: *Conferences, *Radioecology, Biological communities, Ecosystems, Population, Radioactive waste disposal, Radioactivity, Radioactivity effects, Radioisotopes, Water pollution sources, Water pollution effects.
Identifiers: *Proceedings, Ann Arbor (Mich), Ecological Society of America, Freshwater environments, Marine environments, Lapland, Nuclear excavation, Radionuclide cycling, Michigan Univ, US Atomic Energy Commission, Terrestrial environments.

This report comprises Proceedings of Second National Symposium on Radioecology, convened at Ann Arbor, Mich, 15-17 May 1967, and cosponsored by US Atomic Energy Commission, Ecological Society of America, and University of Michigan. Symposium was a response to keen public awareness of diverse problems of environmental contamination from industrial and domestic pollutants, to pesticides, to radioactive wastes from weapons testing, and power plant operations. Report includes text of introductory speaker, John N Wolfe, 'Radioecology: Retrospection and Future'; and plenary session papers as follows: Chet Holifield, 'The Scientist's Responsibility in the Control of Man's Environment'; William E Martin, 'Radioecology and the Feasibility of Nuclear Canal Excavation'; J K Miettinen, 'Enrichment of Radioactivity by Arctic Ecosystems in Finnish Lapland'; and Don W Hayne, 'Implications of Radioecology for Other Research in Environmental Contamination'. Five additional sections of report, with number of individual contributions per section, follow: Population and Community Response to Radiation, (8) Individual and Species Response to Radiation, (10) Radionuclide Cycling in Freshwater Organisms and Environments, (17) Radionuclide Cycling in Marine Organisms and Environments, (21) AND Radionuclide Cycling in Terrestrial Organisms and Environments, (29) Report is indexed. (Eichhorn-Wisc)
W69-07441

GROWTH CHARACTERISTICS OF ALGAE IN RELATION TO THE PROBLEMS OF MASS CULTURE,
Carnegie Institution of Washington, Stanford, Calif. Dept. of Plant Biology.
Jack Myers.
Extracted from ALGAL CULTURE: FROM LABORATORY TO PILOT PLANT, John S Burlew, Editor. Carnegie Institution of Washington Publication 600, Washington, DC. 4 fig, 2 tab.

Descriptors: *Growth rates, *Algae, Photosynthesis, Eutrophication, Light, Temperature, Carbon dioxide, Nutrients, Biological properties, Water pollution effects.
Identifiers: *Mass culture, *Algal growth, Chlorella pyrenoidosa (Emerson strain), Autoinhibitors.

Biological significance of the conditions affecting algal growth is discussed with special reference to Chlorella pyrenoidosa (Emerson strain). Consideration is given to the effect of controlled and measurable conditions, and these results are extrapolated to describe the characteristics of high-density cultures. The effect of light as a limiting factor is discussed also. In particular, growth rates are described as functions of (1) temperature, (2) light intensity, (3) concentration of carbon dioxide, (4) components of the nutrient medium, (5) autoinhibitors, and (6) characteristics of the organism. A specific growth rate of 1.96 per day is considered to be about the maximum rate for C pyrenoidosa and it is concluded that this value is not established by limitations of photosynthesis. (Uttormark-Wisc)
W69-07442

ON THE QUESTION OF THE EFFECT OF GROWTH DURING THE FIRST YEARS OF A FISH'S LIFE ON ITS SUBSEQUENT GROWTH,
D. F. Zamakhaev.
Trans from Tr Vses Nauch Issled Inst Morsk Rybn Khoz i Okeanogr Vol 50, pp 109-141, 1964. Fisheries Research Board of Canada Translation Series No 549, pp 1-39, 1965. 10 fig, 11 tab, 85 ref.

Descriptors: *Growth rates, *Fish, Age, Fish populations, Herrings.
Identifiers: *Lee's phenomenon, *Early growth, *Growth compensation, Caspian shad, Russia, Russian literature, Russian fisheries research, Zander.

Growth during the first year of fishes life has a strong influence on growth during subsequent years. Subsequent years growth is positively correlated with first-year growth, although the effect diminishes with the increasing age of the fish. In many species of fish, rapid first-year growth leads to earlier maturity, and, apparently, earlier physiological senility. An extensive review of the Russian literature regarding the relationships between Lee's phenomenon, growth compensation and first-year growth is given; Western literature (through 1957) is also reviewed. Tabular and graphical data on observed and calculated growth are primarily from Russian sources. (Voigtlander-Wisc)
W69-07443

WATER POLLUTION ASPECTS OF URBAN RUNOFF; THE CAUSES AND REMEDIES OF WATER POLLUTION FROM SURFACE DRAINAGE OF URBAN AREAS.
American Public Works Association, Chicago, Ill. Research Foundation.
For primary bibliographic entry see Field 05B.
W69-07453

THE EFFECT OF INORGANIC SEDIMENT ON STREAM BIOTA,
DePauw Univ., Greencastle, Ind.
James R. Gammon.
Progress Report 1968. 84 p, 18 fig, 30 tab, 22 ref.

Descriptors: Industrial wastes, Quarries, Limestone, Sediments, Sediment yield, *Water pollution effects, Stream pollution, *Standing crop, *Sedimentation rates, Benthic fauna, Density, Fish population, Indiana, Pollution abatement.
Identifiers: Stonedust pollution, Diversity indices, Population density, Macroinvertebrates.

Large quantities of sediment are carried to oceans annually, complicating water treatment, reducing recreation values of water and shortening reservoir life. Massive amounts of sediment also seriously damages aquatic life, but quantitative studies are lacking. Populations of fish in pools and macroinvertebrates in riffles of a small stream were studied in relation to a crushed-rock quarry. In 1967 only 33,600 kg of stonedust entered the stream from the quarry, while in 1968 due to altered quarry operations more than 4.8 million kg were produced. The standing crop of fish in two pools above the quarry averaged 400 kg/ha. The average standing crop in 3 pools below the quarry rose from only 200 kg/ha in June to 250 in August 1967 because of the entry of numerous, small redhorse and longear sunfish. Increased amounts of suspended sediment reduced this to only 100 kg/ha in June 1968 and by September, 2 pools were filled with sediment and contained no fish. Comparable changes were noted in the density of macroinvertebrate populations which nevertheless exhibited comparable diversity indices both above and below the quarry. Few organisms were tolerant to the sediment and a few were notably intolerant, especially carpsuckers and gizzard shad.
W69-07455

MANAGEMENT OF WASTE HEAT FROM THERMAL POWERPLANTS,
Tennessee Valley Authority, Chattanooga. Power Research Staff.
C. J. Powell, and C. H. Waugaman.
Paper at American Public Power Association Engineering and Operations Workshop, Feb. 10-13, 1969, Robert Meyer Hotel, Jacksonville, Fla.

Descriptors: Thermal pollution, *Water pollution control, Temperature control, *Tennessee Valley Authority Project, Powerplants, Water temperature, Zooplankton, Aquatic organisms, Aquatic life, *Fish conservation, Pollution abatement, Aquatic plants.
Identifiers: *Waste heat management, *Water temperature standards.

Water temperature standards being adopted under the Water Pollution Control Act constitute a new constraint in the design and operation of steam electric generating plants. The TVA has conducted at its Paradise Plant in Kentucky five research projects to determine the effects of increased water temperature on aquatic organisms; it is projecting continued research at its Browns Ferry Nuclear

Plant. At Paradise the criterion was reduced to 90 deg F average temperature and a maximum surface temperature of 93 deg F. The principal means of physical control of thermal discharges employed are skimmer walls, submerged dams, diffusers, steam flow regulation, reduction of generation, and cooling towers. (Mills-TVA)
W69-07465

AQUATIC ENVIRONMENT AND FOOD HABITS OF MAYFLIES,
Idaho Univ., Moscow.
M. A. Brusven, and B. R. Gilpin.
Technical Completion Report OWRR Project A-022-IDA, June 1969. 86 p.

Descriptors: *Mayflies, *Food habits, *Ecology, Streams, Behavior, Distribution.

The food habits and ecology were studied for 31 species of mayfly nymphs from the St. Maries River in Idaho, during 1967 and 1968. Mayfly nymphs were basically herbivores feeding on variable amounts of detritus, diatoms and filamentous algae; insects were occasionally consumed. The feeding habits depended largely on the microhabitat of the nymph, e.g. riffle species generally fed more on filamentous algae and diatoms while pool-inhabiting nymphs fed largely on detritus. Different age classes of nymphs usually fed on the same relative composition of food. Nymphs of many mayfly species demonstrated similar microhabitat affinities, although the macrohabitats were often dissimilar. Bottom type and current speed were important factors limiting mayfly distribution. A dendrogram was used to correlate station similarities biotically; several diverse habitats supported the same species. (Warwick-Idaho Univ)
W69-07472

DISPOSAL OF THE EFFLUENTS FROM DESALINATION PLANTS: THE EFFECTS OF COPPER CONTENT, HEAT AND SALINITY,
Dow Chemical Co., Freeport, Tex.
M. A. Zeitoun, E. F. Mandelli, W. F. McIlhenny, and R. O. Reid.
Office of Saline Water, Research and Development Progress Report No. 437, March 1969. 192 p. OSW-14-01-0001-1161.

Descriptors: *Brine disposal, *Brines, *Saline water, *Water pollution, Waste disposal, *Thermal pollution, Effluents, Outlets, Desalination.
Identifiers: *Marine ecology, *Effluent dispersion, *Copper removal, Diffusers.

Criteria for outfall designs were established based on the copper concentration in the effluent from a desalting plant, its concentration after dispersion in the environment and the ecological effects of heat, salinity and copper on the planktonic organisms in the water column. The copper introduced into the brine from existing distillation plants averaged from 0.34 to 0.65 mg/l. Copper was found to be more soluble in sea water concentrates than in sea water, with a minimum solubility at pH 7.5. The removal of copper from brine blowdown by plating on aluminum was found to be technically unfeasible due to side reactions involving evolution of hydrogen. The removal of of copper on Dowex A-1 chelating resin was found to be an efficient process, but the estimated cost would be 4.2 cents/1000 gallons for a 1.5 MGD plant. The use of diffusers to mix the effluent with sea water to reach safe copper concentration by dilution is believed to be a more practical solution than chemical removal or inactivation. (Gransee Office of Saline Water)
W69-07476

DISPOSAL OF THE EFFLUENTS FROM DESALINATION PLANTS INTO ESTUARINE WATERS,
Dow Chemical Co., Freeport, Tex.
M. A. Zeitoun, E. F. Mandelli, and W. F. McIlhenny.
Office of Saline Water, Research and Development Progress Report No. 415, March 1969. 140 p. OSW-14-01-0001-1161.

Descriptors: *Brine disposal, *Brines, Estuaries, *Saline water, *Thermal pollution, Waste disposal, Effluents, Desalination.
Identifiers: *Marine ecology, *Biological effects, Hydrology.

Trends in the development of saline water conversion systems are reviewed. Effluent quantities and characteristics produced by the plants of various sizes and types are evaluated. The hydraulics of the estuary are described and related to the size and type of desalination plant. Biological effects of waste brines on the estuarine resources are discussed. The disposal of effluents from desalination plants into estuarine waters can produce changes in the temperature, salinity, copper concentration, oxygen content, hardness and other minor parameters of the environment. The proper design of an outfall system will minimize environmental changes. Pretreatments that may be found necessary before introduction of the effluent into the receiving estuary are aeration to increase its content of dissolved oxygen or copper removal. (Gransee Office of Saline Water)
W69-07477

EUTROPHICATION--A REVIEW,
Wisconsin Univ., Madison. Water Resources Center.
Kenton M. Stewart, and Gerard A. Rohlich.
Water Quality Control Board, California, Pub No 34, 188 pp, 1967. 4 fig, 611 ref.

Descriptors: *Bibliographies, *Eutrophication, *Reviews, *Water pollution control, *Water pollution effects, *Water pollution sources, Translations, Algicides, Bacteria, Benthos, Bioassay, Chlorophyll, Fertilization, Fish, Harvesting, Hydraulics, Lakes, Limnology, Nutrients, Optical properties, Oxygen, Plankton, Productivity, Radioisotopes, Radioactive dating, Sedimentation, Systematics, Silting, Thermal properties, Vegetation, Water chemistry, Water quality.
Identifiers: Asia, Australia, Case histories, Europe, Laboratory studies, North America, Residence time.

This retrospective critical review of eutrophication considers some 314 documents which are, authors imply, key references bearing on the problem. In addition to study of the diverse literature, they discussed subject with investigators at home and abroad, and the resulting discussions are incorporated into corpus of review. Incorporating material on botany, zoology, limnology, agricultural engineering and areas related to eutrophication, the organization of the report is indicated by its section headings: Introduction; definitions of eutrophication, production, productivity, and blooms; trophic typology of lakes; physical considerations including climate, morphometry, thermal properties, optical properties, hydromechanics, residence time, siltation and sedimentation; nutrient considerations including field and laboratory studies; biological considerations including taxonomy, plankton, fish and bacteria; fertilization studies including examples and research techniques; a variety of case histories, both domestic and foreign; a variety of indices for measuring eutrophication; natural and developmental origin of nutrients and their quantities; desirable and undesirable effects of eutrophication; current methods for prevention and control including land use, effluent diversion, dredging, roughfish harvest, plant harvest, low-flow augmentation, algicides, and nutrient removal from waste waters; and research needs. Report includes a second bibliography to augment literature cited, and appendices of serial titles, conversion factors, and glossary. (Eichhorn-Wisc)
W69-07480

EFFECTS OF HEATED DISCHARGE UPON AQUATIC RESOURCES OF WHITE RIVER AT PETERSBURG,
Indiana Univ., Bloomington. Dept. of Life Sciences.
Max A. Proffitt.
Ind Univ Water Resources Res Center Rep of Invest No 3, Feb 1969. 101 p, 9 fig, 4 plate, 21 tab, 10 ref.

Descriptors: *Thermal pollution, *Heated water, *Thermal powerplants, *Indiana, Water temperature, Biology, Dissolved oxygen, Water chemistry, Water quality, Water pollution effects.
Identifiers: White River (Ind), Petersburg (Ind).

A field study was made of the physical, chemical and biological effects of heated water discharges on the White River at Petersburg, Indiana. The discharge water is about 18-20 deg F warmer than the ambient water temperature and is at times as much as 1/4 of the total river flow. Mixing is complete within 1 mile, and the mixed water temperature is never over 5 deg F warmer than upstream temperatures. The average warming is about 1/2 deg F. Oxygen is not depressed significantly. Negative effects on life are confined to the effluent canal, and some fishes and invertebrates are more abundant in the heated water. The highest recorded river temperature was 107 1/2 deg F. (Knapp-USGS)
W69-07494

FACTORS INITIATING PHYTOPLANKTON BLOOMS AND RESULTING EFFECTS ON DISSOLVED OXYGEN IN DUWAMISH RIVER ESTUARY, SEATTLE, WASHINGTON,
Geological Survey, Washington, D. C.
Eugene Welch.
Geol Surv Water-Supply Pap 1873-A, 1969. 62 p, 22 fig, 5 tab, 45 ref.

Descriptors: *Phytoplankton, *Eutrophication, *Washington, *Estuaries, Aquatic productivity, Nutrients, Oxygen, Plankton, Biochemical oxygen demand, Water circulation, Hydraulics, Currents (Water), Tides.
Identifiers: *Phytoplankton blooms, *Seattle (Wash), Duwamish River.

Phytoplankton productivity, standing stock, and related environmental factors were studied during 1964-66 in the Duwamish River estuary, at Seattle, Wash., to ascertain the factors that affect phytoplankton growth in the estuary. Phytoplankton blooms, primarily of diatoms, occurred in the lower estuary during August 1965 and 1966. No bloom occurred during 1964, but the presence of oxygen-supersaturated surface water in August 1963 indicates that a bloom did occur then. Nutrients probably were not the primary factor controlling the timing of phytoplankton blooms. The consistent coincidence of blooms with minimum fresh-water discharge and tidal exchange during August throughout the study period indicates that bloom timing probably was controlled mostly by hydrographic factors that determine retention time and stability of the surface-water layer. This control was demonstrated in part by a highly significant correlation of gross productivity with retention time and stability of the surface-water layer. This control was demonstrated in part by a highly significant correlation of gross productivity with retention time (as indicated by fresh-water discharge) and vertical stability (as indicated by the difference between mean surface and mean bottom temperatures). The highly significant correlation of chlorophyll (a) with BOD throughout the summer indicates that respiration and decomposition of phytoplankton cells is clearly an important contributor of BOD. A green algal population in vitro did increase in response to added effluents nutrients; however, the available field data suggest that a 46% increase in effluent discharge between 1965 and 1966 did not increase the estuary's phytoplankton biomass significantly. (Knapp-USGS)
W69-07507

PREDICTING DISSOLVED OXYGEN VARIATIONS CAUSED BY ALGAE,
Federal Water Pollution Control Administration, Alameda, Calif. Central Pacific River Basins Project.
Richard C. Bain, Jr.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA5, Pap 6155, pp 867-881, Oct 1968. 15 p, 8 fig, 2 tab, 26 ref, append.

Descriptors: *Dissolved oxygen, *Algae, *Respiration, *Estuaries, *Eutrophication, *California, Water pollution, Reaeration, Nutrients, Oxygen sag, Aeration, Biochemical oxygen demand, Photosynthetic oxygen.
Identifiers: Streeter-Phelps equation, Dissolved oxygen variations, San Joaquin River, Potomac estuary, San Francisco Bay.

Eutrophic environments are often dominated by planktonic algal populations (phytoplankton) which cause diurnal variations in DO concentrations through respiratory activity and photosynthesis. Photosynthetic oxygenation and respiratory deoxygenation rates of estuarine phytoplankton were measured at various standing crop (chlorophyll) levels. Oxygen production and consumption rates for actively growing phytoplankton populations were related to standing crop at 20 deg C and non-limiting light. Variations in algal photosynthetic production rate, as related to light adaption, age of cells, nutrition, temperature and algal type, are considered. The Streeter-Phelps equation was modified to include phytoplankton production and respiration rates in formulations designed to predict DO concentrations over a 24-hr period. An example is given, and the resulting predictions are compared with field measurements from a tidal reach of the San Joaquin River, California. (Knapp-USGS)
W69-07520

CITY OF COLUMBIA V LENTZ (OVERFLOW OF MUNICIPAL SEWAGE SYSTEM).

282 SW 2d 787-793 (Tenn Ct App 1955).

Descriptors: *Tennessee, *Sewage disposal, *Water pollution sources, *Municipal wastes, Pipelines, Cities, Water pollution effects, Impaired water quality, Manholes, Pollutants, Sewage effluents, Legal aspects, Judicial decisions, Damages, Overflow.
Identifiers: Nuisance (Private), Evidence.

Plaintiffs brought this action to recover damages for an alleged nuisance caused by discharge of raw sewage from manholes along defendant city's sewer pipeline onto plaintiffs' farmland and into a creek. Plaintiffs' evidence showed that defendant's sewer line periodically overflowed onto their field and into a creek, permitting raw sewerage to accumulate which gave off foul and noxious odors, polluted the water in the creek, impaired the value of their farm, and rendered plaintiffs' home almost uninhabitable. The court of appeals held that the evidence was sufficient to support the nuisance allegation and the amount of damages recovered. The court noted that such accumulation of effluents and filth constituted actionable nuisance at common law and under the Tennessee statute. It also held that deeds conveying the right of way for the sewer did not give the city the right to overflow sewage through the manholes upon plaintiffs' land, and hence constituted no defense to the action. (Carruthers-Fla)
W69-07635

5D. Waste Treatment Processes

SEWAGE TREATMENT.
For primary bibliographic entry see Field 06E.
W69-07279

WATER SUPPLY AND WATER RECLAMATION FOR NEW DALLAS-FORT WORTH REGIONAL AIRPORT,
Tippetts-Abbett-McCarthy-Stratton, New York.
Edward A. Bryant, and John F. Lenard.
J Water Pollut Contr Federation, Vol 41, No 5, Part 1, pp 772-784, May 1969. 13 p, 5 fig, 8 tab, 10 ref.

Descriptors: *Water reuse, *Airports, Industrial wastes, Water supply, Activated sludge, Lagoons, Sewage treatment, Irrigation water, Waste water disposal.
Identifiers: Dallas (Tex), Fort Worth (Tex).

Engineers have the opportunity at the New Dallas-Fort Worth Regional Airport to recommend a water and wastewater design which is not compromised by existing facilities. After a preliminary study of 13 representative airports, it was decided to provide an average water demand (1975) of 5 mgd (18,900 cu m/day) for the facility--equivalent to a city of 50,000 people. Because of the lack of nearby receiving waters, reuse of wastewaters is planned. The diversity of the waste (from the cleaning of planes and parts, and from domestic, restaurant, and other miscellaneous operations) and the recirculation uses (air-conditioning make-up, irrigation) makes the design problem involved. A special industrial wastes pretreatment scheme for oil separation and neutralization followed by activated sludge and lagooning is planned. (Knapp-USGS)
W69-07360

A MATHEMATICAL MODEL FOR THE CONTINUOUS CULTURE OF MICROORGANISMS UTILIZING INHIBITORY SUBSTRATES,
Clemson Univ., S.C. Environmental Systems Engineering.
John F. Andrews.
Biotechnology and Bioengineering, Vol X, Issue 6, pp 707-723, 1968. 10 fig, 12 ref.

Descriptors: *Mathematical models, *Microorganisms, *Kinetics, Growth rates, Cultures, Biological treatment, Waste treatment, Eutrophication, Water pollution effects.
Identifiers: *Continuous culture, *Inhibitory substrates, Growth kinetics, Batch cultures, Growth inhibition, Substrate-limited growth.

A mathematical model is presented describing the kinetics for both batch and continuous culture of microorganisms utilizing substances which limit growth at low concentrations and inhibit growth at higher concentrations. A key feature of the model is the use of an inhibition function (after Haldane) which relates substrate concentration to specific growth rate. A digital computer was used in simulation studies and it is shown that the primary result of inhibition by substrate in a batch culture is an increase in the lag time, whereas in continuous culture process instability may result. The model is also used to illustrate how process failure may occur during start-up of continuous-flow biological processes as a result of inhibition. The model should be of value in investigations of the stability of biological processes used for the treatment of certain industrial wastes which are known to be inhibitory to many of the organisms metabolizing them. (Uttormark-Wisc)
W69-07439

ABATEMENT OF POLLUTION FROM MINE WASTEWATERS,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 05B.
W69-07490

DYNAMIC OPTIMIZATION FOR INDUSTRIAL WASTE TREATMENT DESIGN,
Weston (Roy F.), Inc., West Chester, Pa.
Chia Shun Shih, and P. Krishnan.
Pap, 24th Annu Purdue Ind Waste Conf, Lafayette, May 6-8, 1969. 18 p, 8 fig, 14 tab.

Descriptors: *Dynamic programming, *Waste water treatment, *Industrial wastes, *Design, Optimization, Decision making, Sequence, Annual costs, Comparative costs.
Identifiers: Multistage treatment sequence.

Dynamic programming was used for the system optimization (cost minimization) of an industrial waste water treatment design. The optimization procedure for a serial multistage system with two-point boundary value was utilized. The objective of the optimization was to identify the least cost combinations and efficiences of various unit processes in a multistage treatment plant required to meet an ultimate water quality standard. After principles of dynamic programming were briefly reviewed, the economic optimization scheme for the wast water treatment plant design was formulated. A specific case in pulp and paper waste water treatment, with cost functions based on process design and engineering evaluations, illustrated the use of the technique. It was concluded that the 'Decision Inversion Method' of dynamic programming could be integrated into a design procedure for industrial waste treatment, but that further research into the interdependency between treatment processes was required. (Gysi-Cornell)
W69-07555

THE USE OF OPERATIONS RESEARCH TECHNIQUES IN WASTEWATER TREATMENT PLANT DESIGN,
North Carolina State Univ., Raleigh.
William S. Galler.
Proc, Nat Symp Anal Water-Resource Syst, pp 225-230, July 1-3, 1968. 6 p, 17 ref.

Descriptors: *Operations research, *Waste water treatment, *Design, Evaluation, Mathematical models, Biological oxygen demand, Optimization, Activated sludge, Stochastic processes, Biological treatment.

The application of operations research techniques to the formulation of wastewater treatment plant design was discussed. The objective of the study was the evaluation of design formulations devised by various individuals for water treatment plants. It was stated that research on the optimal design of waste treatment plants had progressed down two paths. One path followed the treatment plant optimization route in which the total cost of the plant as a whole was minimized. Research along the other path was aimed at determining design criteria for the optimization of unit processes. For the latter method, the biological filter and the activated sludge processes had been investigated. For minimizing total plant cost both stochastic and deterministic mathematical models were used to determine the rate of BDD reduction required. It was concluded that consideration had to be given to the integrated system. One part of the system could not be optimized by itself. All parts had to be considered together. For main entry see W69-07562. (Thiuri-Cornell)
W69-07575

5E. Ultimate Disposal of Wastes

HYDROGEOLOGIC CONSIDERATIONS IN LIQUID WASTE DISPOSAL,
Wisconsin Univ., Madison. Dept. of Geology.
S. M. Born, and D. A. Stephenson.
J Soil and Water Conserv, Vol 24, No 2, pp 52-55, Mar-Apr 1969. 4 p, 2 fig, 7 ref.

Descriptors: *Waste water disposal, *Irrigation, *Sprinkler irrigation, Hydrogeology, Soils, Porosity, Permeability, Groundwater movement, Soil water movement, Infiltration, Percolation, Adsorption, Filtration.
Identifiers: Spray disposal.

The geohydrology of liquid waste disposal by irrigation is reviewed. Knowledge of geologic conditions is necessary for spray irrigation disposal of wastes. The thickness, nature, and distribution of unconsolidated surface deposits determine infiltration, adsorption storage, and downward movement of waste water. Infiltrometer tests may be used in situ, or laboratory examination of samples can yield quicker less accurate information. The condition of

bedrock determines rate of water movement and effectiveness of filtration. Flow systems must be studied to learn where wastes will travel. (Knapp-USGS)
W69-07375

GEOPHYSICAL AND GEOLOGICAL STUDIES OF THE RELATIONSHIPS BETWEEN THE DENVER EARTHQUAKES AND THE ROCKY MOUNTAIN ARSENAL WELL, PART A,
Colorado School of Mines, Golden. Dept. of Geophysics; and Colorado School of Mines, Golden. Dept. of Geology.
For primary bibliographic entry see Field 02F.
W69-07410

PROPERTIES OF THE ROCKY MOUNTAIN ARSENAL DISPOSAL RESERVOIR AND THEIR RELATION TO DERBY EARTHQUAKES,
Colorado School of Mines, Golden. Dept. of Geophysics.
For primary bibliographic entry see Field 02F.
W69-07411

HYDRAULIC CHARACTER OF FRACTURED METAMORPHIC ROCKS OF THE FRONT RANGE AND IMPLICATIONS TO THE ROCKY MOUNTAIN ARSENAL WELL,
Colorado School of Mines, Golden. Dept. of Geology.
For primary bibliographic entry see Field 02F.
W69-07412

FRACTURE DEFORMATION AND CHANGES OF PERMEABILITY AND STORAGE UPON CHANGES OF FLUID PRESSURE,
Colorado School of Mines, Golden. Dept. of Geology.
For primary bibliographic entry see Field 02F.
W69-07413

HYDRODYNAMIC STUDY OF THE WESTERN DENVER BASIN, COLORADO,
Petroleum Research Corp., Denver, Colo.
For primary bibliographic entry see Field 02F.
W69-07414

DISPOSAL OF THE EFFLUENTS FROM DESALINATION PLANTS: THE EFFECTS OF COPPER CONTENT, HEAT AND SALINITY,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 05C.
W69-07476

DISPOSAL OF THE EFFLUENTS FROM DESALINATION PLANTS INTO ESTUARINE WATERS,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 05C.
W69-07477

DESIGN OF SEWER SYSTEMS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 08B.
W69-07574

THE DEPOSIT OF REFUSE IN N Y HARBOR AND ADJACENT WATERS IS PROHIBITED.
For primary bibliographic entry see Field 05G.
W69-07657

5F. Water Treatment and Quality Alteration

DEVELOPMENT OF METHODS FOR CONTROLLING THE COPPER CONTENT IN WATER,
Rhode Island Univ., Kingston. Water Resources Center.
Kenneth H. Mairs.
Completion Report OWRR Project A-014-RI, 1968. 10 p.

Descriptors: *Corrosion control, *Inhibition, *Copper, *Limestone.
Identifiers: *Mineralization, *Soft water, *Well water.

This project had two major objectives: (1) to study the means by which copper becomes soluble in water and (2) to devise means or methods by which soluble copper could be controlled or reduced to acceptable limits. The overall reaction for corrosion of copper in mildly acid solution has been demonstrated to be: 2 Cuz 2Hzz 1/2 02x 2 Cuzz H2O. In order for this reaction to proceed, the water must be acidic and contain oxygen. This condition is found in many soft, natural waters. To limit the copper content, one must either destroy the aggressiveness or remove the copper as the water is used. Obviously the first approach is more desirable. A neutralizing filter proved to be a simple effective inexpensive control device. Basically, this filter is a deep bed of limestone chips which reacts with and reduces the free carbon dioxide content of raw water. While corrosion and soluble copper is effectively controlled, the bicarbonate hardness and pH are increased appreciable. (Rose-Rhode Island Univ)
W69-07471

OPTIMUM DESIGN OF WATER FILTRATION PLANTS,
Iowa State Univ., Ames. Engineering Research Inst.
E. Robert Baumann.
Proc, Nat Symp Anal Wat r-Resource Syst, pp 195-217, Denver, July 1-3, 1968. 25 p, 8 fig, 8 tab, 14 ref.

Descriptors: *Hydraulic design, *Filtration, *Optimization, *Mathematical models, Timing, Correlation analysis, Digital computers, Water supply, Economic efficiency, Design, Head loss, Water quality, Water treatment.
Identifiers: *Diatomite filters, Gilter cakes.

A 'Program for Optimization of Plant Operation', (POPO) was described for the design of diatomite filtration plants for operation at least cost. Mathematical models were developed to predict head-loss time relationships for a diatomite filter under varying operating conditions. Filter cake resistance coefficients were collected and correlated to measurable filtration variables. Through the use of a computer program the cost combinations of filtration designs were specified. It was found that the POPO has potential in the determination of least cost combinations of water filtration design and operating parameters. The size of the plant was found to have significant effects on the minimum cost. Optimum filtration rate increased with plant size. For main entry see W69-07562. (Thiuri-Cornell)
W69-07573

RAW-WATER QUALITY CRITERIA FOR PUBLIC SUPPLIES,
Robert J. Becker, Elwood L. Bean, Byron Beattie, H. H. Budd, and Richard L. Woodward.
Journal of American Water Works Association, Vol 61, No 3, pp 133-138, Mar 1969. 6 p, 10 ref, 2 tab.

Descriptors: *Water quality, *Standards, *Water quality control, *Supply, Water, Color, Color reactions, Odor, Water temperature, Turbidity, Coliforms, Alkalinity, Ammonia, Inorganic compounds, Metals, Boron, Salts, Dissolved oxygen, Fluorides, Hardness (Water), Nitrites, Nitrates, Hydrogen ion concentration, Phosphorus, Dissolved solids, Pesticides.

Criteria for the concentration of various substances which affect raw-water quality are set forth. The criteria are set for considered treatment processes which were thought most commonly used nationwide: coagulation, sedimentation, sand filtration and disinfection with chlorine. The report discusses, in limited detail, the subcommittee's findings as to desirable criteria relating to eighteen classifications of substances. There are two levels of criteria. Permissible criteria are those characteristics and concentrations of substances in raw water which will permit the production of acceptable public water after treatment by one or more of the methods set forth above. Desirable criteria are those characteristics and concentrations of substances which represent high-quality water in all respects. The criteria set forth in the report are to be used with substantial discretion because of the great regional variations in raw water quality. (Blunt-Fla)
W69-07578

DISPOSAL OF SEWAGE.
For primary bibliographic entry see Field 05G.
W69-07599

5G. Water Quality Control

SEWAGE TREATMENT.
For primary bibliographic entry see Field 06E.
W69-07279

WATER POLLUTION CONTROL.
W Va Code Ann sec 20-5A-17 through 20-5A-24 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Water pollution control, *Administrative agencies, *Abatement, Legislation, Regulation, Water pollution, Water pollution sources, Permits, Local governments, Jurisdiction, Water pollution effects, Fishkill, Aquatic life, Natural resources.
Identifiers: *Criminal law, Injunctions (Mandatory), Injunctions (Prohibitory).

The chief of the division of water resources may apply to the circuit court for the abatement of any water pollution which he deems a nuisance. Application shall be made to the circuit court of the county where the alleged water pollution is occurring. In cases of aggravated pollution where irreparable harm will result from any delay, the chief may apply for an immediate temporary injunction. Any person who fails to discharge any duty imposed on him by law or order of the chief is guilty of a misdemeanor. If such failure to obey any duty causes loss of game-fish or aquatic life, the state department of natural resources shall bring action to recover a sum equal to the cost of replacement. There is no criminal liability for a violation caused by an act of God, war, riot, or catastrophe which is not caused by negligence or wilful misconduct. If any provision of this article is invalid, such invalidity shall not affect the other provisions of the article. (Stewart-Fla)
W69-07281

POLLUTION ABATEMENT (POWERS AND DUTIES OF DEPARTMENT OF WATER RESOURCES).

Md Ann Code, Art 96A:23-29 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Water pollution control, *Water quality control, *Pollution abatement, Water pollution, Water quality, Treatment facilities, Legislation, Water pollution treatment, Water resources development, Administrative agencies, Coordination, Planning, Regulation, Remedies, Legal aspects, Water users, Project planning, Water control, Oil, Oil wastes, Appropriation, Competing uses.
Identifiers: Penalties (Criminal), Injunctions.

The Maryland Department of Water Resources has the duty to study and recommend means of pollution abatement, and the Department may encourage voluntary cooperation among competing

interests. The Department may enforce and assist other agencies in enforcing existing pollution laws. It shall also be authorized to conduct research and develop additional information on pollution. The Department may receive complaints, conduct hearings upon proper notice, and issue orders directing persons causing pollution to secure specified results; if such results are not secured, the person may be directed to install proper and practicable treatment facilities. The Department may also review and make recommendations to other state agencies which may be causing pollution. In addition, the agency may establish reasonable water quality standards. The Department has the right of entry upon any property, and the duty to periodically review appropriation permits. Criminal penalties and injunctions are available to the agency to insure compliance with the act's provisions. Specific enforcement provisions have been made applicable to oil discharge. (Wheeler-Fla)
W69-07284

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION.

Conn Gen Stat Ann sec 25-67, 25-68 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *New England Interstate WPS Compact, *Water pollution control, *Pollution abatement, Interstate compacts, Interstate commissions, Legislation, Water law, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, Interstate rivers, Planning, Financing.
Identifiers: *Interstate waters, Water classification.

The New England Interstate Water Pollution Control Commission is composed of the Commissioner of Health, the Director of the Water Resources Commission, and the governors of three signatory states. The purpose of the pollution control compact between Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont is to abate the pollution of interstate waters. The compact provisions apply to all waters contiguous to two or more signatory states. There are to be 5 commissioners from each state and a majority of the 5 must approve any action obligatory upon the state. THhe commission may recommend legislative action to carry out the purpose of the compact, but it may not pledge the credit of any signatory state. The commission will impose no single standard of water quality; however, each state is called upon to submit classifications of use for their interstate waters from which the commission will recommend standards for water classification. Each state agrees to abate and control pollution consistent with the classified use of each body of water. Costs of administration are to be proportionately borne by the signatory states. The commission may enter into agreements with New York concerning pollution abatement. (Holt-Fla)
W69-07287

WATER POLLUTION CONTROL.

Conn Gen Stat Ann 25-54a through 25-54aa (Supp 1968).

Descriptors: *Connecticut, *Water pollution control, *Administrative agencies, *State governments, Streams, Water resources development, Water conservation, Water supply, Water utilization, Condemnation, Eminent domain, Water harvesting, Subsurface waters, Surface waters, Public benefits, Public health, Public rights, Wastes, Pollution abatement, Legal aspects, Potable water, Water quality, Water users, Hydraulic structures, Legislation.

Water pollution is recognized by statute to be inimical to public health. The Water Resources Commission was created to prevent future pollution and to abate existing pollution of a thermal or chemical nature. The Commission is charged with development of comprehensive anti-pollution programs. The Commission is to require submission of plans and specifications for the construction or modification of pollution abatement facilities. Standards of water quality applicable to the various waters of the state shall be adopted by the Commission in order to further public welfare and to conserve wildlife. These standards shall be consistent with those established by the Board of Health and shall not be adopted in final form without undergoing the scrutiny of a public hearing. The Commission may order any municipality to cease and desist from polluting public waters. After 1 May 1967, a permit shall be required before any person may discharge water or material into state waters. Persons discharging substances into state waters prior to this date may substantially change the volume or flow thereof. The Commission may make a grant to any municipality which constructs or rebuilds a pollution abatement facility. (Katz-Fla)
W69-07288

WATER POLLUTION CONTROL.

Conn Gen Stat Ann sec 25-54a to 25-54d (Supp 1968).

Descriptors: *Connecticut, *Administrative agencies, *State governments, Legislation, Streams, Water resources development, Water conservation, Water supply, Water utilization, Condemnation, Eminent domain, Water harvesting, Subsurface waters, Surface waters, Public benefits, Public health, Public rights, Wastes, Water pollution control, Pollution abatement, Legal aspects, Potable water, Water quality, Water users, Hydraulic structures, Sewage disposal, Project planning, Permits, Administrative decisions.

The Water Resources Commission is charged with the general supervision and administration of this statute. The Commission shall develop comprehensive programs for the prevention, control and abatement of existing pollution of state waters. The responsibility for coordination of water policy objectives between local, state and federal agencies rests with the Commission. Studies, investigations and demonstrations concerning water pollution shall be conducted by the Commission. The Commission may issue, modify or revoke orders regarding the abatement of water pollution. All plans and specifications for modification or construction of disposal systems or pollution abatement systems must be submitted to the Commission. Upon approval of such plans, a permit will be issued authorizing the proponent to proceed. The Commission is granted the power to exercise all incidental powers necessary to carry out the purposes of this provision. (Katz-Fla)
W69-07289

WATER POLLUTION CONTROL.

Conn Gen Stat Ann sec 25-54e to 25-54aa (Supp 1968).

Descriptors: *Connecticut, *Administrative agencies, *State governments, Legislation, Streams, Water resources development, Water conservation, Water supply, Water utilization, Condemnation, Eminent domain, Water harvesting, Subsurface waters, Surface waters, Public benefits, Public health, Public rights, Legal aspects, Potable water, Water quality, Water users, Hydraulic structures, Standards, Cost sharing, Wastes, Water pollution control, Pollution abatement.

The Commission shall adopt standards of water quality applicable to various state waters. These standards shall at least conform with the Federal Water Pollution Control Act. Such standards shall not sanction the discharge of untreated sewerage into state waters under any circumstances. These standards shall apply to all intrastate and interstate waters as designated by the Commission. Prior to adoption of any water quality standard, the Commission must conduct a public hearing. Adequate notice of the hearing and of the proposed quality standard is required. The Commission may issue an abatement order to any municipality which is causing pollution of state waters. Any municipality which constructs or acquires a pollution abatement facility may receive a grant from the Commission equal to thirty per cent of the cost of such facility. The Water Resources Commission may accept available federal aid. Provisions are set forth providing for advancements of state funds to municipalities in anticipation of receipt of federal funds for pollution abatement facility construction. (Katz-Fla)
W69-07290

WATER POLLUTION CONTROL; SANITARY DISTRICTS WATER POLLUTION CONTROL ACT.

Minn Stat Ann secs 115.01 to 115.09 (1964).

Descriptors: *Minnesota, *Water pollution control, *Permits, *Legal aspects, Sewage, Industrial wastes, Disposal, State governments, Sewage disposal, Legislation, Administrative agencies, Planning, Standards, Investigations, Pollution abatement, Sanitary engineering, Adjudication procedure.
Identifiers: *Interstate cooperation, *Legal administration, *Appeal of administrative orders, *Evidence, Nuisances (Public).

The commission is empowered to investigate pollution, order discontinuance of waste discharge, issue disposal permits, hold hearings, issue subpoenas, examine witnesses, administer oaths, have access to public and private property, and examine records. No final order of the commission shall affect vested rights without notice and hearing. Appeal as in civil trials may be had with the appellant and commission being parties. The state may intervene. A record of the decision appealed from shall be made available. The action and findings of the commission shall be prima facie reasonable and valid, with the burden of proof upon the appellant. The commission may cooperate with other states, the United States or Canada, relating to water pollution control, and may receive money from any source for use in water pollution control. It is unlawful to construct, operate, or extend a disposal system without a written permit. Permits shall be issued to presently operating systems, subject to modification or revocation. Pollution may be enjoined as a public nuisance. (Harris-Fla)
W69-07294

POLLUTION CONTROL AGENCY.

Minn Stat Ann secs 116.01 to 116.09 (Supp 1969).

Descriptors: *Minnesota, *Water pollution control, *Administrative agencies, *Pollution abatement, Land use, Solid wastes, Interstate, Water purification, Legislation, Federal government, Investigations, Planning, Standards, State governments, Public benefits.
Identifiers: *Minnesota Pollution Control Agency.

To achieve water purity in the public interest, a pollution control agency is hereby established as successor to the water pollution control commission, and shall be organized with seven members (terms and selection detailed). The director shall be appointed to a term coincident to the governor's. The governor may replace directors at his pleasure. The agency is authorized to cooperate with other agencies and with state and federal governments in the public interest. The agency is empowered to adopt standards of air quality and otherwise control air pollution. The agency shall study and investigate problems of solid waste control and land use in areas affected by air and water pollution and shall make reports and recommendations to the governor and legislature. Recommendations may include comprehensive control and abatement plans, and land use standards. (Harris-Fla)
W69-07295

BANKS V TOWN OF BURNSVILLE (SUIT TO ENJOIN CITY FROM EMPTYING SEWAGE INTO STREAM).

228 N C 553, 46 SE 2d 559-561 (1948).

Descriptors: *North Carolina, *Potable water, *Municipal wastes, *Water pollution, Pollution abatement, Public health, Sewage, Waste disposal, Water supply, Cities, Streams, Riparian land, Judicial decisions, Legal aspects.
Identifiers: Demurrer.

Plaintiffs brought suit to enjoin defendant municipality from emptying sewage into a slow running stream. Following a showing that defendant was in fact disposing of sewage into the stream, the trial court granted the injunction. On appeal, the trial court was reversed. The appellate court noted that plaintiffs did not allege that they owned land abutting upon or contiguous to this stream, nor that the stream was used as a source for public drinking water. Defendant's demurrer should have been sustained. The court held that, where public drinking water is concerned, municipal activities may be enjoined at the insistence of any person. However, if no public drinking water supply is involved, the individual seeking relief must allege that he owns land adjacent to such stream and that the acts complained of are such as to constitute a nuisance causing irreparable damage to him. Failure to allege the above mentioned elements was fatal to plaintiffs' cause. (Logan-Fla)
W69-07307

SLAGLE V CITY OF EAST LIVERPOOL (SUIT FOR WASHOUT DAMAGES AND POLLUTION ABATEMENT).
For primary bibliographic entry see Field 06E.
W69-07312

CITY OF WEST FRANKFORT V FULLOP (SUIT TO ENJOIN DRILLING AND OPERATION OF GAS AND OIL WELLS).

6 Ill 2d 609, 129 NE 2d 682-688 (1955).

Descriptors: *Illinois, *Water pollution control, *Zoning, *Drainage districts, Water supply, Oil wells, Drilling, Water pollution, Public health, Local governments, Potable water, Impaired water quality, Water quality control, Public benefits, Judicial decisions, Pollution abatement, Pollutant identification, Cities, Remedies.
Identifiers: Injunctions (Prohibitory).

Plaintiff brought this suit to enjoin operation and drilling of gas and oil wells within an area surrounding a lake. The lake constituted the plaintiff city's water supply. The city passed an ordinance declaring the lake area to be a drainage basin and prohibiting drilling or operation of oil wells. The defendants alleged that this was an unlawful taking of property without due process of law. The court held that the city had statutory power to enact this ordinance and that the statute was not unconstitutional. The police power to protect public water supply against pollution may be delegated to cities. The plaintiff city's ordinance was held to be a valid exercise of the police power, and the injunctive relief against oil well pollution was deemed proper. The court further held that when it was apparent that pollution would follow drilling operations, injunctive relief could be granted before defendants even started operations. (Kelly-Fla)
W69-07322

SEWERS AND DRAINS.
For primary bibliographic entry see Field 06E.
W69-07327

DEGRADATION OF GAMMA-BHC IN SIMULATED LAKE IMPOUNDMENTS AS AFFECTED BY AERATION,
Wisconsin Univ., Madison. Dept. of Soils.
Leo W. Newland, Gordon Chesters, and Gerhard B. Lee.
J Water Pollut Contr Federation, Vol 41, No 5, Part 2, pp R174-R188, May 1969. 15 p, 7 fig, 1 tab, 28 ref. OWRR Grant No B-016-WIS.

Descriptors: *Insecticides, *Biodegradation, *Lakes, Model studies, Anaerobic conditions, Anaerobic bacteria, Aerobic conditions, Aerobic bacteria, Dissolved oxygen, Gas chromatography.
Identifiers: Benzene hexachloride, Insecticide detoxification.

The degradation of gamma-BHC (a benzene hexachloride isomer) in simulated aerobic and anerobic lake impoundments was determined. Anerobic degradation was much more rapid than aerobic degradation. In the aerobic simulated lake impoundment, degradation of 15 percent of the added gamma-BHC occurred in 2,100 hr and the isomer alpha-BHC was formed as the degradation product. In the anerobic impoundment 90% of the added gamma-BHC was degraded in the 2,100 hr incubation period to the isomers alpha and delta-BHC. Because of the profound effect of oxygen on degradation rates and the apparent 'lag phase' of the reaction, it is concluded that the isomerization of gamma-BHC occurs by a biological mechanism. The isomerization leads to detoxification of the insecticide.
W69-07364

IRRIGATION AS A MENACE TO HEALTH IN CALIFORNIA: A NINETEENTH CENTURY VIEW,
California Univ., Davis. Dept. of Geography.
For primary bibliographic entry see Field 06B.
W69-07372

MINE WASTEWATER PROBLEMS IN EUROPE,
Pennsylvania Dept. of Mines and Mineral Industry, Harrisburg. Div. of Research and Development.
David R. Maneval.
Proc 22nd Ind Waste Conf, May 2-4, 1967, Part 2, Purdue Univ, pp 608-619, 1967. 12 p, 9 fig.

Descriptors: *Acid mine water, *Water pollution control, Waste water treatment, Injection wells, Drainage, Groundwater, Aquifers, Filtration, Industrial wastes, Municipal wastes, Sewage treatment.
Identifiers: *European mine-water practices.

The cooperative approach of managing the water resources and water quality of a watershed which seems to be gathering strength in the United Kingdom, the Netherlands, Belgium, and Germany has many economic advantages. In most of the countries there is extensive research going on in connection with water pollution problems associated with the coal industry. In some countries, some aspects of this research are far advanced over that in the United States. European experience, particularly in England, clearly indicates that well-coordinated research efforts in the mine drainage and preparation plant effluent field by personnel permanently assigned to such research is of great benefit to the industry and to water pollution efforts. Most of the countries are ahead of the United States in the abatement of pollution from coal-processing plants. Usually, requirements in Europe regarding the discharge of solids from such plants are more stringent than they are in Pennsylvania. More effort should be put forth to review the European literature in this field and to provide for a more continuing exchange of technical information between European and American experts. The joint treatment of domestic and industrial wastes, observed in Europe, is of considerable economic benefit. Efforts in this direction should be expanded as much as possible. (Knapp-USGS)
W69-07418

THE CONTROL OF ACID MINE DRAINAGE POLLUTION BY BIOCHEMICAL OXIDATION AND LIMESTONE NEUTRALIZATION TREATMENT,
National Coal Board, Rotherham (England). Div. of Mine Water Investigation.
H. Gordon Glover.
Proc 22nd Ind Waste Conf, May 2-4, 1967, Part 2, Purdue Univ, pp 823-847, 1967. 25 p, 11 fig, 3 tab, 59 ref.

Descriptors: *Acid mine water, *Water pollution control, *Biodegradation, Waste water treatment, Iron bacteria, Sulfur bacteria, Neutralization, Limestone, Sulfates, Iron, Acid bacteria, Acid streams.
Identifiers: Acid mine drainage treatment.

A new process for the purification of acid drainage from coal mining operations is described. Novel features include the biochemical oxidation of ferrous salts in acid solution and the application of mechanical attrition to limestone grit which is used for the chemical neutralization of the oxidized drainage. The new process will be most applicable to the more dilute acid drainages for which the conventional lime process is less suitable, and the costs of the new process, where applicable, are expected to be appreciably less than the costs of the lime process. (Knapp-USGS)
W69-07419

REAERATION MEASUREMENTS IN A EUTROPHIC STREAM,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
W. A. Glain, and A. J. McDonnell.
Proc 22nd Ind Waste Conf, May 2-4, 1967, Part 2, Purdue Univ, pp 1044-1058, 1967. 15 p, 7 fig, 5 tab, 13 ref, 2 append.

Descriptors: *Reaeration, *Water pollution, *Streamflow, Turbulence, Slopes, Velocity, Channel morphology, Biodegradation, Oxygen sag, Dissolved oxygen, Oxygenation, Waste assimilative capacity.
Identifiers: Reaeration of eutrophic streams.

Reaeration was studied in a eutrophic stream in Pennsylvania, and observations were compared with predictions made by standard methods. In most cases, predictions by the methods of Owens were too high, while those by Churchill's formula were too low. For the study reaches investigated, corrections to reaeration coefficients reduced estimates as much as 40%. For steam bed slope, velocity, and depth ranges of 1.7 to 4.5 ft/1000 ft, 0.3 to 1.1 fps, and 0.90 to 1.8 ft; respectively, the empirical equation of Churchill best defined observed variability but the isotropic turbulence formula of O'Connor and Dobbins most accurately predicted observed reaeration coefficients. (Knapp-USGS)
W69-07420

ECONOMICS OF INDUCED RIVER AERATION,
Rutgers - The State Univ., New Brunswick, N. J.
William Whipple, Jr.
ASME/AIChE Stream Pollution Abatement Conference June 12, 1969. 21 p, 4 fig, 2 tab, 9 ref.

Descriptors: *Water quality control, *Aeration, *Dissolved oxygen, *Reaeration, Organic loading, Water pollution, Biochemical oxygen demand, Oxygen sag, Economics, Water pollution effects, Stream pollution, Water quality, Oxygenation.
Identifiers: *Artificial river aeration, *Induced river aeration, Unrecorded pollution, Unrecorded organic loading, BOD concentration, BOD loading.

A demonstration grant and several research programs related to possibilities of adding to the dissolved oxygen of streams by artificial means, or induced river aeration, has been underway for several years. This paper summarizes the general conclusions and certain economic considerations, and will be followed by a more detailed report. It is shown that for small polluted rivers induced river

aeration is an entirely practicable alternative to advanced waste treatment and is apt to be much less expensive. The procedures for measuring oxygen transfer rate in tanks and lagoons are not generally applicable to rivers. On rivers such as the Passaic River, the existence of large amounts of unrecorded man-made pollution makes it unrealistic to attempt to maintain high levels of dissolved oxygen by treatment above. Induced river aeration may be not only the most economical alternative but the only practicable means of achieving such goals. (Whipple-Rutgers)
W69-07446

WATER POLLUTION ASPECTS OF URBAN RUNOFF; THE CAUSES AND REMEDIES OF WATER POLLUTION FROM SURFACE DRAINAGE OF URBAN AREAS.
American Public Works Association, Chicago, Ill. Research Foundation.
For primary bibliographic entry see Field 05B.
W69-07453

WASTE DISPOSAL COSTS OF A FLORIDA PHOSPHATE OPERATION,
Bureau of Mines, Knoxville, Tenn. Knoxville Office of Mineral Resources.
J. R. Boyle.
Available from U. S. Gov't. Printing Office, Wash., D. C., for 35 cents.

Descriptors: Construction costs, Dam design, Earth dams, Environment, Flocculants, Hydraulic excavation, *Phosphates, *Pollution abatement, Research and development, Resource conservation, Slimes, *Waste disposal, Water conservation, *Water costs, Water management, *Water pollution source, Water recirculation.

The waste disposal method used at the International Minerals and Chemical Corporations's Noralyn Phosphate Operations in Polk County, Fla., was studied to develop cost estimates, provide better knowledge of current practices, guide consideration of alternative methods and identify possible areas of research. Cost estimates were based on capacities of existing facilities, but the phosphate production and slime generation statistics used in the calculations were estimates rather than data drawn from company records. Cost estimates represent a basis for calculating waste disposal costs for other phosphate plants which utilize the same method of disposal. Total operating cost of disposal is estimated to be 33.0 cents per ton of product based on an assumed 4.5 million tons of slime per year. Net operating cost is estimated to be 24.5 cents per ton of product after credit of 8.5 cents per ton for recirculated water from the settling ponds to the plant. To conserve mineral resources and to improve environmental conditions, research should be directed to developing alternative methods of disposal, including the recovery of the P2O5 values from the slimes and the dewatering of the slimes.
W69-07454

MANAGEMENT OF WASTE HEAT FROM THERMAL POWERPLANTS,
Tennessee Valley Authority, Chattanooga. Power Research Staff.
For primary bibliographic entry see Field 05C.
W69-07465

DESIGN OF DAMS FOR MILL TAILINGS,
Bureau of Mines, Washington, D. C.
C. D. Kealy, and R. L. Soderberg.
Bureau of Mines, Information Circular 8410, 1969. 49 p, 25 fig, 11 ref, 1 append.

Descriptors: *Waste disposal, *Mill dams, *Strip mine wastes, Earth dams, Surface drainage, Mine wastes, Permeability, Flow nets, Slope stability, Hydraulic gradient, Phreatic line, Dam failure, Safety factor, Seepage, Computer programs.

The Bureau of Mines studied tailings disposal problems at mines throughout the United States to identify design principles that can be applied to all types of dams for mill trailings. Computer programs for stability analysis and phreatic waterline estimation are also reviewed in this circular, which presents the Bureau's recommendations for constructing effective, long-lasting tailing dams.
W69-07473

A STUDY OF THE EXPENDITURES FOR URBAN WATER SERVICES,
Travelers Research Corp., Hartford, Conn.
For primary bibliographic entry see Field 06C.
W69-07483

SEWERED DRAINAGE CATCHMENTS IN MAJOR CITIES,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
For primary bibliographic entry see Field 02A.
W69-07486

EROSION CONTROL AT HOLLINGER MINE TAILING SITE,
Hollinger Consolidated Gold Mines Ltd., Timmins (Ontario).
For primary bibliographic entry see Field 02J.
W69-07489

ESTUARINE WATER QUALITY MANAGEMENT,
California State Water Resources Control Board, Sacramento. San Francisco Bay-Delta Program.
Richard L. Rosenberger, and Raymond Walsh.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA5, Pap 6164, pp 913-926, Oct 1968. 14 p, 3 fig, 4 ref.

Descriptors: *Water quality control, *Estuaries, *California, Water resources development, Water management (Applied), Sewage treatment, Water pollution control, Deltas.
Identifiers: San Francisco Bay.

The San Francisco Bay-Delta Water Quality Control Program is a 3-yr study to develop a comprehensive plan for water quality control in the San Francisco Bay-Sacramento-San Joaquin Delta area of California. The program's total study area covers nearly 40% of the state. Vast water development projects will ultimately result in the complete control of inflow to the Delta and Bay during a substantial portion of most years. In developing a comprehensive water quality control plan the effect these projects will have on water quality must be considered along with problems resulting from disposal of agricultural drainage and the more conventional water pollution related factors associated with population and economic growth. The ultimate plan for water quality control in the Bay-Delta area, to be completely successful, will need to have incorporated into it the concepts of total water resources management. The implementation of such a plan will require the full cooperation of federal, state, and local water development agencies. (Knapp-USGS)
W69-07522

THE ADMINISTRATION OF OFFSHORE MINERAL LEASING STATUTES IN THE GULF OF MEXICO (LOUISIANA AND TEXAS),
G. Hardy, III.
Nat Resources Lawyer, Vol 1, No 3, pp 70-102, July 1968. 33 p, 62 ref.

Descriptors: *Louisiana, *Texas, Leases, *Land use, Federal jurisdiction, State jurisdiction, Natural resources, Administrative agencies, Conservation, Boundaries (Property), Oil, Gases, Sulfur, Shores, Coasts, Mineral industry, Gulf of Mexico, Marine geology, Interagency cooperation, Federal-state water rights conflicts.

The author traces the history and the past and present problems encountered by the states of Louisiana and Texas in establishing and administering leasing statutes and policies regarding offshore areas. He reveals in detail the administrative structure and operation of, respectively, the Louisiana State Mineral Board and the School Land Board of Texas. Sample offshore leases from both states are included as appendices to the article. The author notes the leasing custom and practice in both states. He utilizes the bulk of the article to describe various problem areas regarding offshore leases which both Louisiana and Texas have faced and he compares the policies and efforts of the two states to meet such problems. Among the problem areas he discusses are: (1) the impact of offshore leasing of land for oil and gas operations on competing uses of marine resources, (2) various administrative problems, (3) the federal-state relationships regarding the administration of offshore lands, specifically, pollution, conservation, and boundary problems, and (4) intergovernmental relations within each state as regards the leasing of offshore lands. (Carruthers-Fla)
W69-07577

RAW-WATER QUALITY CRITERIA FOR PUBLIC SUPPLIES,
For primary bibliographic entry see Field 05F.
W69-07578

NATIONAL WATER COMM'N.
For primary bibliographic entry see Field 06E.
W69-07580

PASSAIC VALLEY SEWERAGE DISTRICT.
N J Stat Ann sec 58:14-34.1, 58:14-34.2, 58:14-34.10 to 58:14-34.12 (1966).

Descriptors: *New Jersey, *Sewage, *Sewage disposal, *Drainage system, Administration, Administrative agencies, Legislation, Legal aspects, Water law, Financing, Financial Feasibility.

The Passaic Valley Sewerage Commissioners were authorized to enter into leases for the use of the intercepting sewers to dispose of additional sewage from a drainage area of the Passaic River. The legislature declared that there was a need for repair, replacement, and improvement of the existing sewerage system and that the expense for this was a part of the cost of maintenance, repair and operation. It was further declared that the old system of financing was insufficient and inequitable for financing the new work; and that there was a need to afford a practical means of relief by which the contracting municipalities could pay the expenses on an economical and reasonable basis over a reasonable number of years. The commissioners were given the power to enter into contracts that would facilitate the maintenance, reconstruction, and operation of the sewerage system. They were also given the authority to acquire all property deemed necessary or incident to any of the projects. (Holt-Fla)
W69-07585

DISPOSAL OF SEWAGE.
Conn Gen Stat Ann secs 25-25 through 25-31 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Sewage disposal, *Sewage, *Pollution abatement, Pollutants, Legislation, State governments, Adjudication procedure, Public health, Sewage treatment, Cities, Administrative regulation.
Identifiers: Penalties, State waters.

The terms 'waters of the state' and 'sewage' are defined. The discharge into waters of the state of sewage prejudicial to public health is prohibited. The Commissioner of Health is given power to inspect and order alterations in all existing sewerage systems. No new systems may be built without the Commissioner's approval of the plan. The State

Department of Health, upon its own motion or at the request of city officials, may investigate alleged pollution sources. Appeals from department orders may be made to the county superior court. The Department shall bring complaints in the superior court of Hartford County for failure to comply with its orders and the court may inforce the order in any appropriate manner. Nothing in the statute shall be construed as recognizing a vested right to discharge sewage into state waters. The penalty for such discharge shall be a fine of not more than $500 and/or imprisonment of not more than six months. (Kahle-Fla)
W69-07599

WATER AND ICE SUPPLIES.

Conn Gen Stat Ann sec 25-32 thru 25-54 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Administrative agencies, *State governments, *Water supply, Legislation, Streams, Water resources development, Water conservation, Water utilization, Condemnation, Legal aspects, Eminent domain, Water harvesting, Subsurface waters, Surface waters, Public benefits, Public health, Public rights, Wastes, Water pollution control, Pollution abatement, Remedies, Adjudication procedure, Ice, Reservoirs.
Identifiers: Injunctions (Mandatory).

The Department of Health has jurisdiction over all matters concerning the purity and adequacy of any public source of water or ice. The Department may investigate any public system of water or ice supply and shall issue such orders as are necessary to prevent future pollution and to remedy any existing contamination. Orders of the Department are reviewable by the superior court upon petition by an aggrieved party. It shall be a misdemeanor to put or leave a dead animal in any public water source. Cemeteries are not to be constructed within one-half mile of any reservoir used by the public unless the superior court finds that the proposed cemetery will not be detrimental to public health. Municipalities charged with the responsibility of water supply operations may initiate condemnation proceedings in superior court in furtherance of such operation. Bathing in and pollution of public reservoirs is declared to constitute a misdemeanor. The Department is authorized to promulgate regulations protecting interstate waters from pollution. Ice brought into the state for domestic use shall be inspected by the Commissioner of Health. Injunctive relief may be granted to abate pollution of public water sources. (Katz-Fla)
W69-07600

CHIEF OF DIVISION OF WATER RESOURCES AND WATER RESOURCES BOARD.

W Va Code Ann sec 20-5A-3 thru 20-5A-4 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Water pollution, *Water pollution control, *Water resources, Pollutants, Pollution abatement, Water pollution effects, Water pollution sources, Water pollution treatment, Water conservation, Disposal, Public health, Standards, Federal government, Legal aspects, Legislation, Regulation, Administrative agencies, Investigations.

The chief of the division of water resources is empowered to encourage voluntary cooperation by all persons in controlling and reducing water pollution in the state. He may advise and consult with other state governments and agencies and with the federal government regarding scientific or other pertinent investigations. He may also receive money for carrying out these studies. The chief shall encourage plans by municipalities and businesses to control water pollution and educate the public concerning water pollution. The chief has the power and responsibility of ascertaining the extent of pollution in the state's waters and of enforcing sanctions against such pollution. The water resources board may promulgate rules and regulations to implement the powers of the board and of the chief, and has the authority to make investigations concerning water pollution. The board is also authorized to create public service districts to better control and reduce pollution in unincorporated areas. The division of water resources is designated as the water pollution control agency for West Virginia, for all purposes of the federal Water Pollution Control Act. (Kelly-Fla)
W69-07606

POLLUTION ABATEMENT AND CONTROL.
W Va Code Ann sec 20-5A-9 thru 20-5A-14 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Water pollution control, *Pollution abatement, *Disposal, Water pollution sources, Water pollution treatment, Water conservation, Legal aspects, Legislation, Public health, Sewage, Sewage disposal, Waste water disposal, Effluents, Industrial wastes, Permits, Administrative agencies, Discharge (Water$_0$.

The chief of the state's division of water resources may require persons who directly or indirectly discharge sewage or other wastes into or near waters of the state to file information concerning the characteristics, amount, and rate of flow of the discharge. Upon determining that any person is causing water pollution, the chief may issue orders requiring either that the waste discharge be halted, or that remedial action be taken to reduce pollution in the discharge to the extent that such action is practical and economically feasible. If the order requires remedial action, the person causing the pollution must seek a permit and begin appropriate steps to eliminate or reduce pollution in accordance with the order. Failure of the governing body of a municipality or corporation to vote funds for necessary action will not excuse non-compliance. The chief may extend the time limit fixed by his original order. Compliance with a past order issued by the division implies no right to continue existing pollution of the state's waters, and the state maintains the right to take necessary action in the future. (Kelley-Fla)
W69-07607

STATE DEPARTMENT OF HEALTH.
W Va Code Ann secs 16-1-3, 16-1-9 (1966), sec 16-1-9a (Supp 1968).

Descriptors: *West Virginia, *Public health, *Water quality control, *Sewage treatment, Water supply, Legislation, Cities, Diseases, Environmental sanitation, Fluoridation, Potable water, Social aspects, Water pollution, Water purification, Chemical wastes, Sanitary engineering, Sewage disposal, Bacteria, Biological treatment, Recreation, Drainage, Public benefits, Administrative agencies, Inspection, Filtration, Chlorination.

The state board of health is created to assume the obligations of all previously existing health agencies. The board has the duty of enforcing all laws respecting public health. It can inspect and control the sanitary conditions of streams, water supplies, and sewage facilities. The board may regulate public water systems, plumbing systems, sewage systems and treatment plants, swimming pools, chlorination and filtration plants, and the qualifications of those in control of the plants. A municipality may not establish any method of drainage unless such method shall be approved by the state department of health. If the department finds that an existing system is dangerous to public health, it may order alterations in such system. The board of health shall prescribe the bacteriological limits to which all public water supplies will conform. The board may also prescribe regulations limiting the chemical and physical qualities of water. (Shevin-Fla)
W69-07608

FLOATING SAWDUST INTO STREAMS.
Ga Code Ann sec 26-3701 (1953), as amended, (Supp 1968).

Descriptors: *Georgia, *Streams, *Sawdust, *Wood wastes, Legislation, Local governments, Wastes, Water law, Legal aspects, Organic matter, Waste disposal, Water pollution sources, Water pollution control, Legal aspects.

The floating of sawdust into streams is made unlawful. Violation of the law is a misdemeanor. However, the law only goes into effect in counties where it has been recommended by two grand juries in the county. (Childs-Fla)
W69-07617

DEPOSIT OF REFUSE IN NAVIGABLE WATERS.
33 USCA secs 407, 407a (1957), as amended, (Supp 1969).

Descriptors: *Legislation, *Federal government, *Navigable waters, Harbors, Bays, Navigable rivers, Obstruction to flow, Bridges, Dams, Permits, Regulation, Bulkhead line, Coastal structures, Docks, Jetties, Piers, *Waste disposal.
Identifiers: Corps of Engineers.

It is unlawful to discharge in any manner, from either shore or vessel, any refuse matter of any kind whatsoever, other than that in liquid form, into any navigable water of the United States or into any tributary thereof. When, the chief of the Corps of Engineers feels that anchorage and navigation will not be injured, the Secretary of the Army may permit waste disposal into navigable waters. The Secretary may limit or condition such discharge at his discretion and may grant a permit accordingly. In places where harbor lines have not been established and where deposits of debris of mines or stamp works can be made without injury to navigation, the Secretary may establish harbor lines and authorize such deposits to be made. It is unlawful for any person to use or take possession of any construction used by the federal government to preserve or improve navigable waters. (Katz-Fla)
W69-07646

PROTECTION OF NAVIGABLE WATERS - REGULATION OF TRANSPORTATION AND DUMPING REFUSE IN NAVIGABLE WATERS - PIERS AND CRIBS ON MISSISSIPPI AND ST CROIX RIVERS.

33 USCA secs 419, 420 (1957).

Descriptors: *Waste disposal, *Federal government, *Legislation, *Navigable water, Transportation, Oysters, Dredging, Navigation, State jurisdiction, Piers, Mississippi River, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: St Croix River, Corps of Engineers.

The Secretary of the Army is authorized to prescribe regulations to govern the transportation and dumping into any navigable water, or waters adjacent thereto, of dredgings, earth, garbage, and other refuse materials of every kind or description, whenever in his judgment such regulations are required in the interest of navigation. Such regulations shall be posted in conspicuous places for the information of the public, and any person or corporation which shall violate the regulations shall be deemed guilty of a misdemeanor. This section does not apply to any waters within the jurisdictional boundaries of any state which are now or may hereafter be used for the cultivation of oysters under the laws of such state, except navigable channels which have been or may hereafter be improved by the United States. The owners of sawmills on the Mississippi River and the Saint Croix River in the states of Wisconsin and Minnesota are authorized to construct piers or cribs in front of their mill property on the banks of the river, provided that the piers or cribs so constructed shall not

interfere with or obstruct the navigation of the river. (SmithnFla)
W69-07647

PROTECTION OF NAVIGABLE WATERS - DEPOSIT OF REFUSE IN LAKE MICHIGAN NEAR CHICAGO.

33 USCA sec 421 (1957).

Descriptors: *Lake Michigan, *Water pollution control, *Federal government, *Legislation, Lakes, Waste disposal, Navigation, Illinois, Water supply, Indiana, Breakwaters, Federal jurisdiction, Navigable water, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Corps of Engineers.

It is unlawful to discharge or cause to be discharged any refuse matter of any kind into Lake Michigan at any point opposite of Cook county Illinois or Lake county Indiana, within eight miles from the shore of the lake, unless such refuse shall be placed inside of a breakwater so arranged as not to permit its escape into the body of the lake and cause contamination. The provisions of this section do not apply to the construction, repair, and protection of breakwaters and other structures built in aid of navigation, or for the purpose of obtaining water supply. Any person violating any provision of this section is guilty of a misdemeanor. (Smith-Fla)
W69-07648

OIL POLLUTION OF COASTAL WATERS - PROHIBITION AGAINST DISCHARGE OF OIL IN UNITED STATES WATERS.

33 USCA secs 431, 432, 433, 434 (1957).

Descriptors: *Oil, *Water pollution control, *Federal government, *Legislation, Water pollution, Coasts, Ships, Navigation, Public health, Federal jurisdiction, Navigable waters, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Secretary of the Army.

Except in case of emergency, imperiling life or property, or unavoidable accident, collision, or stranding, and except as otherwise permitted by regulations prescribed by the Secretary of the Interior, it is unlawful for any person to discharge or permit the discharge of oil from any boat or vessel into or upon the navigable waters of the United States and its adjoining shorelines. Any person discharging or permitting the discharge of oil from any vessel into such waters shall remove the vessel from the waters immediately. If such owner fails to do so, the Secretary may remove the oil or may arrange for its removal, at the owner's expense. These coasts and expenses shall constitute a lien on such vessel which may be recovered in proceedings by libel in rem. Any person who violates this section is punishable upon conviction by a fine not exceeding $2,500, or by imprisonment not exceeding one year, or by both fine and imprisonment for each offense. Any boat or vessel, other than those owned and operated by the United States, from which oil is discharged in violation of this section shall be liable for a penalty of not more than $10,000. (Smith-Fla)
W69-07656

THE DEPOSIT OF REFUSE IN N Y HARBOR AND ADJACENT WATERS IS PROHIBITED.

33 USCA secs 441, 442, 443, 444 (1957).

Descriptors: *New York, *Waste disposal, *Legislation, *Federal government, Sewers, Harbors, Permits, Ships, Federal jurisdiction, Navigable waters, Federal-state water rights conflicts, Water resources development, Navigable rivers.

The placing or discharging in any manner of refuse, dirt, dredgings, or other matter in the waters of the harbors of New York, Hampton Roads, or Baltimore, within the limits which shall be prescribed by the supervisor of the harbor, is forbidden. A violation of this section is a misdemeanor punishable by fine or imprisonment. In addition to the above penalties, any master or engineer, or persons acting in that capacity, on board any vessel who knowingly violate this section shall, upon conviction, have his license revoked or suspended for a term to be fixed by the judge. Whenever any such forbidden matter is received on board any scow or other vessel, the owner or master, before proceeding to take or tow the refuse to the place of deposit, shall apply for a permit defining the precise limits within which the discharge may be made. Any deviation from such discharging place specified in the permit is a misdemeanor. (Smith-Fla)
W69-07657

WATER POLLUTION CONTROL - CONGRESSIONAL DECLARATION OF POLICY.

33 USCA secs 466, 466-1, 466a, 466b, 466c (1967 Supp).

Descriptors: *Water policy, *Water pollution control, *Federal government, *Legislation, State jurisdiction, Pollution abatement, Cost sharing, Administrative agencies, Water pollution, Surface waters, Groundwater, Coordination, Water pollution sources, Federal jurisdiction, Navigable waters, Federal-state water rights conflicts, Water resources development, Navigable rivers, Cities.
Identifiers: Secretary of Health, Education and Welfare.

The policy of Congress concerning waterways is to recognize, preserve and protect the primary responsibilities and rights of the states in preventing and controlling water pollution, to support technical research relating to the prevention and control of water pollution, and to provide federal technical services and financial aid to state and interstate agencies and to municipalities in connection with the prevention and control of water pollution. A Federal Water Pollution Control Administration is created within the Department of Health, Education and Welfare by this section. The Secretary shall prepare comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries and improving the sanitary condition of surface and underground waters. The Secretary shall encourage cooperative activities by the states for the prevention and control of water pollution, and encourage the enactment of improved uniform state laws relating to the prevention and control of water pollution. (Smith-Fla)
W69-07658

WATER POLLUTION CONTROL - GRANTS FOR WATER POLLUTION CONTROL PROGRAMS - WATER POLLUTION CONTROL ADVISORY BOARD.

33 USCA sec 466d to 466h (1967 Supp).

Descriptors: *Water pollution treatment, *Federal government, *Legislation, *Navigable waters, Water pollution waste treatment, Sewage, Sewage treatment, Waste disposal, Water purification, Industrial pollution, Cost sharing, Administrative agencies, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers, Cities.
Identifiers: Secretary of Health, Education and Welfare, Water Pollution Control Advisory Board.

Five million dollars is authorized to be appropriated for the fiscal year ending June 30, 1967, and for each succeeding fiscal year to and including the fiscal year ending June 30, 1971. The Surgeon General is authorized to make grants to any state, municipality, or intermunicipal or interstate agency for the construction of necessary treatment works to prevent the discharge of untreated or inadequately treated sewage into any waters. This section enumerates the limitations of such federal grants and requires a determination of the desirability of all proposed projects. A Water Pollution Control Advisory Board is established within the Department of Health, Education, and Welfare. It is composed of the Secretary or his designee, who shall be chairman, and nine members appointed by the President, none of whom shall be federal officers or employees. The pollution of interstate or navigable waters in or adjacent to any state or states which endangers the health or welfare of any persons shall be subject to abatement action as provided in this section. Any federal department or agency having jurisdiction over any building, installation, or other property, shall, insofar as practicable, cooperate in preventing the pollution of such waters with the Department and any state or agency having jurisdiction over waters into which any matter is discharged from such property. (Smith-Fla)
W69-07659

NAVIGATION AND NAVIGABLE WATERS.

33 USCA secs 466i, 466j, 466l, 466m, 466n (1969 Supp).

Descriptors: *Federal government, *Pollution abatement, *Water quality control, *Water pollution control, United States, Legislation, Navigable waters, Legal aspects, Sewage treatment, Water pollution sources, Sewage, Boats, Ships, Administrative agencies, Financing, Costs, Taxes, Treatment facilities, Industrial plants, Standards, Water quality, Economic impact, Investigations, Data collections, Waste disposal, Water pollution, Industrial waste, Municipal wastes.
Identifiers: *Litter, *Federal-state cooperation, Secretary of Health, Education, and Welfare.

In connection with water pollution control, the Secretary of Health, Education and Welfare may utilize members of federal agencies and prescribe regulations to carry out the purposes of sections 466-466g and 466h-466k of this title. The Secretary may prescribe the keeping and disclosure of records by recipients of assistance under those sections, and shall have access to any records pertinent to the grants received under them. The Secretary, in cooperation with state pollution control agencies, shall make detailed studies of the economic impact of treatment facilities on governmental units, and the standards required to meet national and state water quality standards in terms of cost and personnel. The Secretary of the Interior shall conduct a full investigation on pollution of navigable waters caused by litter and sewage deposited in the waters from watercraft, and/or means of abatement of such pollution. A report and recommendations shall be submitted to Congress. The Secretary of the Interior shall fully investigate methods of providing tax incentives and other financial assistance to industry to construct facilities to abate pollution. (Harris-Fla)
W69-07660

DAUGHERTY V CITY OF LEXINGTON (REASONABLE USE OF LAND).

249 SW 2d 755-759 (Ky 1952).

Descriptors: *Kentucky, *Reservoir storage, *Reasonable use, *Sewage disposal, Local governments, Natural use, Water pollution sources, Consumptive use, Sewage treatment, Water supply, Water storage, Water rates, Remedies, Judicial decisions, Public benefits, Land tenure, Compensation.

Plaintiff owned land near and above a privately owned artificial lake from which the City of Lexington obtained its water. The county board of adjustment refused to grant plaintiff a permit to erect a restaurant and tourist cabin, fearing that the sewage from such businesses might pollute the city's water supply. Plaintiff brought suit to reverse this action. Plaintiff contended that his sewage control system was adequate and that to deny him this reasonable use of the land would be the equivalent

of taking his property without compensation. Moreover, such taking would not be for the benefit of the public but for the benefit of the private water company. Plaintiff appealed from a dismissal of his suit in the circuit court. The court affirmed the lower court's action, noting that the water company, whose rates were regulated by the state, was in reality only a management corporation allowed to make a reasonable profit. The public had a direct interest in preventing appellant from using his land so as to endanger the public's water source, since any added purification costs would be reflected in their water rates. (Gabrielson-Fla)
W69-07674

INTERSTATE COMM'N ON THE POTOMAC RIVER BASIN.
Md Ann Code art 403, sec 407 (Supp 1968).

Descriptors: *Maryland, *Interstate commissions, *Interstate compacts, *Interstate rivers, River basin commissions, River basins, Virginia, West Virginia, Pennsylvania, District of Columbia, Standards, Regulation, Research and development, Water pollution control, Water pollution sources, Industrial wastes, Watersheds (Basins), Investigations, Pollutant identification.
Identifiers: Potomac River, Potomac Valley Conservancy Dist.

A compact with the purpose of abating pollution in the Potomac River Basin, is entered into by Maryland, West Virginia, Virginia, Pennsylvania and the District of Columbia. This compact creates the Interstate Commission on the Potomac River Basin and the Potomac Valley Conservancy District which comprises all areas drained by the Potomac. A commission consisting of the governor of Maryland and two members appointed by him for two year terms is created to act with like commissions of the other signatory bodies. The commissioners of each signatory board shall serve without compensation, other than for expenses incurred. The commission shall elect officers, appoint assistants, and adopt regulations for its management. No action of the commission shall be binding on any signatory body unless two commissioners from that body voted in its favor. The commission shall have the powers and duties to collect and disseminate existing information regarding pollution in the conservancy district and to collect new data through investigation. It shall cooperate with legislative bodies to promote uniform laws and to recommend minimum standards for pollution control in the conservancy district. The commission shall be financed by prorata contributions from the signatory bodies, the total of which shall not exceed $30,000 per annum. Any signatory body may withdraw from the compact after one year's notice. (Kahle--Fla)
W69-07691

ABATEMENT OF NUISANCES.

Del Code Ann tit 16, sec 310 (1953).

Descriptors: *Delaware, *Pollution abatement, *Stagnant water, *Water pollution sources, Odor, Public health, Diseases, Legal aspects, Legislation, Sanitary engineering, Soil contamination, Water pollution, Cities, Local governments.

Each local board of health may order the removal of any noisome matter, filthy place, reservoir of stagnant water or other nuisance which in its opinion is conducive to sickness or ill-health. The Board may order the persons responsible for causing any such nuisance to abate, remove or remedy the nuisance. (Helwig-Fla)
W69-07692

HEALTH AND SAFETY.
Del Code Ann tit 16, secs 7907, 7929, 7930, 7931 (1953).

Descriptors: *Delaware, *Inspection, *Sewage, *Administrative agencies, Legislation, Evaluation, On-site investigations, On-site tests, Regulation, Water law, Legal aspects, Sewage disposal, Sewers, Cesspools, Waste disposal, Environmental sanitation, Potable water, Permits, Public health, Waste water (Pollution), Sanitary engineering, Social aspects, Water quality, Storm drains, Wells, Well permits, Water supply, Runoff, Plumbing.
Identifiers: Storm water sewage system.

Agents of the State Board of Health inspect and supervise all water and sewer systems, building and house drainage systems and their ventilation. Plumbing inspectors may enter any building or premises in the state when necessary for the performance of their duties and may inspect and order the removal of any plumbing fixture, pipe, or cesspool which they deem to be in an unsanitary condition. Storm waters must be drained into a storm water sewerage system or a combined sewerage system but not into a sanitary sewerage system intended for sewerage only. Privy vaults or cesspools are not permitted on premises accessible to a public sewer. Where a public water supply is available, dug wells or other sources of private water supply are unlawful unless approved in writing by the Board. (Johnson-Fla)
W69-07695

CESSPOOLS, PRIVY WELLS AND DRAINAGE SYSTEMS.

Del Code Ann tit 16, secs 1501-1507, (1953).

Descriptors: *Delaware, *Cesspools, *Waste disposal, *Drainage systems, Local governments, Administrative agencies, Waste water disposal, Drainage water, Sewage systems, Water supply, Drainage practices, Outlets, Sewers, Surface drainage, Legislation, Seepage, Administrative regulation, Water pollution, Water pollution control, Public health, Sewage disposal.
Identifiers: Privy wells.

The State Board of Health may regulate the construction of all cesspools, privy wells and other drainage systems within all towns and within 1 mile of the water supply thereof. The Board may order any changes in such drainage systems already constructed so as to protect public health and may order the owner thereof to construct such from brick or concrete to prevent the contents from seeping into the soil. The Board may prohibit the discharge of sewage over the surface of the ground. It may order the cleaning of any drainage system. All plans for the construction of water or sewage systems shall be submitted to the Board for approval. Violators of this chapter or regulations made pursuant to it shall be fined. (Helwig-Fla)
W69-07696

POLLUTION OF STREAMS.

Del Code Ann tit 16, secs 1301, 1302 (1953).

Descriptors: *Delaware, *Water pollution, *Streams, *Water pollution sources, Pollution abatement, Public health, Wastes, Industrial wastes, Water quality, Chemcontrol, Sewage, Organic wastes, Legislation, Judicial decisions, Water supply, Hogs, Water quality control.
Identifiers: Dye-stuffs, Slaughter houses.

No person shall discharge or allow any dye-stuffs, drugs, or chemicals which cause the stream to become noxious to the health or disagreeable to the senses to escape into any stream used as a water supply. In addition to imposing a fine for violation, the court shall also issue an abatement order within 20 days after conviction. The abatement shall be enforced by the sheriff. No person shall place a privy, hog-pen or slaughter house so as to pollute any stream with the excrement or offal therefrom. Violators shall be fined and the court shall order the nuisance abated immediately. (Helwig-Fla)
W69-07697

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

OPERATIONS RESEARCH STUDY OF WATER RESOURCES IN AN URBANIZED ARID ENVIRONMENT,
Arizona Univ., Tucson.
Chester C. Kisiel, and Lucien Duckstein.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 24 p, 4 fig, 2 tab, 33 ref, map.

Descriptors: *Systems analysis, *Water resources planning, *River basin development, *Arid lands, River forecasting, Runoff forecasting, Competing uses, Conservation, Water management (Applied), Project planning, City planning, Long-term planning, Short-term planning, Economic efficiency, Estimating equations, Computers, Arizona.

This paper briefly reviews the philosophy of systems analysis or operations research, presents a progress report on application of this methodology to water resources development and management in the Tucson basin, Arizona, and presents a strategy for a study of the efficiency of data collection systems. Emphasis is on an integrated systems approach with the Tucson area as a field laboratory for improvement of methodology. Details of the basins water problems include economic growth, mining industry, agriculture and the municipal sector. Digital computer models of the physical system consider transferability of point precipitation data, time series analysis of actual stream flows and variability of natural recharge. Two different management approach models are examined for a community water supply, (a) to meet projected requirements at minimum costs, (b) to maximize net benefits accruing from water use. Efficiency of data collecting systems are evaluated in terms of economic efficiency, information content and worth in terms of construction of mathematical models of the physical system and water management schemes. The objectives of groundwater management models for the Tucson basin are enumerated. (Sherbrooke-Ariz)
W69-07350

WATER AND THE CITIES: CONTEMPORARY URBAN WATER RESOURCE AND RELATED LAND PLANNING,
Abt Associates, Inc., Cambridge, Mass.
For primary bibliographic entry see Field 06B.
W69-07479

DYNAMIC OPTIMIZATION FOR INDUSTRIAL WASTE TREATMENT DESIGN,
Weston (Roy F.), Inc., West Chester, Pa.
For primary bibliographic entry see Field 05D.
W69-07555

ANALYSIS OF WATER-RESOURCE SYSTEMS,
American Water Resources Association, Urbana, Ill.
Rolf A. Deininger, Martha N. Francisco, and Arnold I. Johnson.
Proc Nat Symp on Anal Water-Resource Syst, July 1-3, 1968, Univ of Denver, Colo. 390 p.

Descriptors: *Systems analysis, *Synthetic hydrology, Model studies, Groundwater, Surface waters, Water pollution, Estuaries, Water resources development, Water management (Applied), Water pollution control, Desalination, Water yield, Water sources, Mathematical models, Cost analysis, Optimization, Linear programming, Dynamic programming.
Identifiers: Water resources systems.

The use of systems analysis techniques in water resource management is discussed in 30 papers. The topics covered are systems analysis in various phases of water management, groundwater systems

analysis, systems analysis in water supply and pollution control, surface water systems analysis, and estuary water quality and quantity systems. The uses of dynamic an linear programming are discussed, considering the stochastic nature of most hydrological data series. Systems analysis is an approach to evaluating the effects of varying parameters in complex systems with multiple interactions, with the aid of mathematical models solved by digital computers. See also W69-07563 thru W69-07575. (Knapp-USGS)
W69-07562

DYNAMIC PROGRAMMING IN WATER RESOURCES DEVELOPMENT,
Texas Univ., Austin; and Texas A and M Univ., College Station.
C. S. Beightler, and W. L. Meier.
Proc, Nat Symp Anal Water-Resource Syst, pp 64-71, Denver, July 1968. 8 p, 3 fig, 10 ref.

Descriptors: *Dynamic programming, *Water resources development, Optimum development plans, Decision making, River systems.
Identifiers: *Non-serial systems.

The technique of dynamic programming for determining the optimum level of development in water resource systems was outlined. The recursive relationship for a serial multistage system was developed. State variables were the inputs and outputs (e.g. flows) at each stage. The decision variables were the levels of development at each stage. Transformation functions relating inputs and development levels to outputs at each stage were assumed. The objective was to maximize the returns (functions of inputs and levels of development at each stage) from the system. The technique was then generalized to a branched system, with the recursive optimization technique working upstream as before until the first branch was reached. There, the two-decision, one-state optimization step was decomposed by the Principle of Optimality into an equivalent one-state, one-decision optimization. It was concluded that using the 'pseudo-stages' which resulted from the decomposition, that any branched multistage problem could be solved as a one-state, one-decision serial dynamic programming problem. For main entry see W69-07562. (Gysi-Cornell)
W69-07564

SYSTEMS ANALYSIS AND BASIN PLANNING FOR WATER RESOURCES MANAGEMENT,
Illinois State Water Survey, Urbana.
Robert H. Harmeson.
Proc, Nat Symp Anal Water-Resource Syst, pp 72-78, Denver, July 1968. 7 p, 2 fig.

Descriptors: *Systems analysis, *Water management (Applied), *River basins, *Planning, Water resources development, Water pollution control, Water supply, Recreation, Flood control, Air pollution.
Identifiers: Illinois Water Resources Model.

An effort by the State of Illinois to develop methodology of systems analysis, which could be used in devising the general strategy for the coordinated planning of water resources development and management throughout the state, was reported. A report entitled 'Water for Illinois--A Plan for Action', which addressed itself to the problems of water and land-related resources for the target dates of 1980 and 2020, was outlined. The report recommended the use of a comprehensive and detailed systems analysis of the State's total water resource, relating to water supply and use, water quality control, recreational water use, flood control, and to soil and water conservation measures. To develop an Illinois Water Resources Model, the state was divided into eight quasi-river basin areas. An attempt to develop sub-models for the various stated purposes, and to integrate the sub-systems into a regional optimization model was discussed. For main entry see W69-07562. (Gysi-Cornell)
W69-07565

GENERAL SYSTEMS APPROACH TO GROUNDWATER PROBLEMS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 04B.
W69-07567

ON MULTILEVEL OPTIMIZATION IN GROUNDWATER SYSTEMS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 04B.
W69-07570

SYSTEMS ANALYSIS FOR WATER SUPPLY AND POLLUTION CONTROL,
Harvard Univ., Cambridge, Mass.
Joseph J. Harrington.
Proc, Nat Symp Anal Water-Resource Syst, pp 144-166, Denver, July 1968. 23 p, 82 ref.

Descriptors: *Systems analysis, *Water supply, *Water pollution control, *Mathematical models, Sanitary engineering, Water distribution (Applied), Cost analysis, Waste water treatment, Waste water disposal, Water treatment, Regional analysis, Engineering education, Demand, Publications, Reviews.

The stated purpose of the paper was 'to give a cursory overview of applications of systems techniques to the provision of water and the collection and acceptable disposal of waste water.' An extensive listing of past and present systems studies in the water supply-disposal area followed. The background and traditional approach to water supply and dispoal design problems was given. Studies on the development of cost data for design were listed. Systems studies for water distribution system design, maintenance (leak detection and metering), waste water treatment, unit processes, staged development of treatment works, suburban waste water disposal, metrology-automation and control, and miscellaneous studies in water treatment, waste water collection, regionalization, demand estimation, parameter estimation and model design, phase interchanges and social implications of engineering systems, and curriculum considerations were briefly described. It was concluded that most existing models are sub-optimization models and should be regarded as 'preliminary screening' tools that serve as guides but which must be tempered by judgment. For entry see W69-07562. (Gysi-Cornell)
W69-07571

COMPUTER SOLUTIONS TO DISTRIBUTION NETWORK PROBLEMS,
Boeing Co., Renton, Wash.
For primary bibliographic entry see Field 07A.
W69-07572

6B. Evaluation Process

THE DEVELOPMENT OF INTERNATIONAL WATER RESOURCES: THE 'DRAINAGE BASIN APPROACH',
For primary bibliographic entry see Field 06E.
W69-07305

DELAWARE RIVER BASIN WATER COMM'N COMPACT.
For primary bibliographic entry see Field 06E.
W69-07329

INCREASING THE POTENTIAL OF FUTURE WATER DEVELOPMENTS THROUGH IMPROVED ENGINEERING MANAGEMENT,
Bureau of Reclamation, Denver, Colo.
B. P. Bellport.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 26 p.

Descriptors: *Arid lands, *Water resources planning, *Water resources development, Artificial precipitation, Evaporation, Evaporation control, Reservoir evaporation, Desalination, Water conservation, Monomolecular films, Phreatophytes, Demonstration farms, Irrigation efficiency, Computer programs, Engineering personnel, Decision making, Systems analysis.
Identifiers: *Bureau of Reclamation.

This paper summarizes the Bureau of Reclamation's programs which deal with the expanding water resources needs of arid regions and their challenges to engineering managerial expertise. The value and economy of using systems engineering in the decision-making process is discussed. The Bureau's activities in importation of water, both interbasin and undersea, are presented. The value of the electronic computer in more sophisticated analytical procedures and its reduction of waste and cost is stressed, especially as related to construction planning. Pipeline and irrigation canal systems are compared. The Bureau is studying ways by which irrigation can achieve higher crop yields with less water and is investigating the scientific means for computing irrigation times and amounts for use in an automatic computerized system of maximum efficiency. Other areas of research outlined are weather modification, desalination, efficient evaporation-reduction materials, and control of phreatophytes. A review of the Bureau's programs aimed at improvement of managerial and technical skills to meet the complex problems of future water resources development is included. (Sherbrooke-Ariz)
W69-07345

PROJECTING HYDROLOGIC AND ECONOMIC INTERRELATIONSHIPS IN GROUNDWATER BASIN MANAGEMENT,
Arizona Univ., Tucson.
William E. Martin, Thomas G. Burdak, and Robert A. Young.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 15 p, 1 fig, 1 tab, 12 ref.

Descriptors: *Economic evaluation, *Groundwater, *Analog models, *Hydrologic data, Arid lands, Aquifers, Deep-well pumping, Border irrigation, Water demand, Irrigation practices, Irrigation wells, Arizona, Decision making, Analytical techniques, Projections, Inter-basin transfers, Economic prediction, Water management, Wells, Pumping.

This study is a computerized approach to an analysis of groundwater problems in arid areas having high irrigational demands. In order to provide a criteria for projecting the consequences of alternative water management schemes for Pinal Co., Arizona, a procedure using both formal economic and hydrologic models was devised. The projected reactions of farmers using pumped water to changing economic conditions and public policies is presented for representative farms by linear programming models. Traditional optimization assumptions of economic theory are employed. The hydrology of the underground water basin is represented by an electric-analog model of the U.S.G.S. Projection for the next 50 years shows a gradual decline in low-valued, marginal crops and the economic disadvantages of water importation rescue operations. (Sherbrooke-Ariz)
W69-07353

IRRIGATION AS A MENACE TO HEALTH IN CALIFORNIA: A NINETEENTH CENTURY VIEW,
California Univ., Davis. Dept. of Geography.
Kenneth Thompson.
Geogr Rev, Vol 59, No 2, pp 195-214, Apr 1969. 20 p, 1 tab, 80 ref.

Descriptors: *Irrigation water, *Environmental effects, *California, *Irrigated land, Parasitism, Marshes, Statistics, Rice, Land reclamation, Vegetation effects, Climates, Summer, Winter.
Identifiers: Irrigation health effect.

Irrigation effects on health, mainly as a 19th century view held in California, are discussed on the basis of earlier publications in California. The article contains the following chapters: (1) the nature of malaria; (2) the prevalence of malaria in California; (3) official inquiries; (4) context of the irrigation fear; (5) California concern over irrigation; (6) opposition to irrigation; (7) neutralism and qualified support; (8) the positive attitude; and (9) the controversy in perspective. The author summarizes the study by stating that the neutral or more or less optimistic view of irrigation development eventually proved to be justified. Moreover medical science turned its attention to microbiology and the microorganism became the focus of concern and the medical climatology and medical topography, so popular in nineteenth-century California and elsewhere, are virtually abandoned. (Gabriel-USGS)
W69-07372

SUCCESS OF WATERSHED DEVELOPMENT IN LOCAL COMMUNITIES,
Oklahoma State Univ., Stillwater.
Thomas P. Cox.
Natur Resources J, Vol 9, No 1, pp 23-34, Jan 1969. 12 p, 1 fig, 4 tab.

Descriptors: *Water resources development, *Watersheds (Basins), *Watershed management, *Oklahoma, Statistical methods, Regression analysis, Political aspects, Social aspects, Governments.
Identifiers: Factor analysis.

Factor analysis was applied to the programs of 115 watershed development projects in Oklahoma, and it was found that the interest and involvement of the whole community was more important in promoting development than was the influence of any limited-interest group, even conservation and water development agencies. A surprising finding was that community standard of living and watershed development are not linearly related, but the highest development rates are associated with the highest and lowest community living standards, with the lowest rates at intermediate community levels. (Knapp-USGS)
W69-07392

AQUEDUCT EMPIRE,
Erwin Cooper.
Glendale, Calif, Arthur H. Clark Co, 1968. 439 p, 38 photo, 1 map, index.

Descriptors: *Water resources development, *California, Water management (Applied), Municipal water, Irrigation water, Industrial water, Dams, Aqueducts, River training, Water wells, Desalination, Water law, Flood control, Mining, Water pollution control, Lakes, Reservoirs, Recreation, Multiple-purpose projects.
Identifiers: California water development.

California's water resources development is described in a popular history book that emphasizes the construction of dams, aqueducts, and other large engineering projects. The growth of population and of per capita water consumption is discussed in terms of the challenges successfully met and those projected for the future in a State with uneven distribution of rainfall, and with the heaviest population and agricultural development in the driest areas. Irrigation water, municipal water, and industrial water are all intensely developed in California, and with a projected doubling of population by the year 2000, together with the expected per capita use increase, the problems to be met will be enormous. Flood control, river training, and pollution control projects are also discussed. (Knapp-USGS)
W69-07415

TRITON CITY: A PROTOTYPE FLOATING COMMUNITY.
Triton Foundation, Inc., Cambridge, Mass.
Available from Clearinghouse for Federal Scientific and Technical Information, Springfield, Va., as report PB-180 051 at $3.00 in paper copy and $0.65 in microfiche, November 1968. 15 p, 1 append, 23 ref.

Descriptors: *Waterfront development, *Community development, *Prototypes, Structural design, Neighborhood development, Social aspects, Population density, Economic feasibility, Technical feasibility.
Identifiers: *Floating community.

A feasibility study to determine the possibility of developing the water areas of major cities by floating new communities on the water adjacent to the urban core, the technical considerations indicate that such a structure is possible. The basic unit of Triton City is a neighborhood-sized community which will accommodate 3500 to 6000 people and which will support an elementary school, a small supermarket and local convenience stores and services. Three to six of these neighborhoods will form a town which will include a high school, more recreational and civic facilities and possibly light industry. When a community reaches the level of three to seven towns (90,000 to 105,000 population) it becomes a full-scale city with more specialized industry and a city center module to accommodate government offices and medical facilities. The high density occupation results in great economies in transportation service and other utilities. One of the other important benefits of this type of development is the advantage of waterfront living in the central city - urban convenience and suburban open space. (Starr-Chicago)
W69-07448

WATER RESOURCES PROBLEMS AND RESEARCH NEEDS,
A. W. Snell.
Water Resource Research Institute, Clemson University, S. C. Proceedings - Sixteenth SWRPCC - 1967, pp 161-167. 7 p, 8 ref.

Descriptors: *Research and development, Systems analysis, Flood plains, Industrial wastes, Judicial decisions, Site selection, Economic impact.
Identifiers: Local participation.

Research needs for effective water resources planning are cited in this article. They include: (1) Economic value of water in various uses; (2) impact of water resources development on economic growth; (3) economics of management of flood plains; (4) the biochemical effect of present and projected disposal practices of industries and municipalities; (5) economics of site selection; (6) compilation of court decisions and statute laws relating to water use and water rights; and (7) compilation of population and industrial projected needs to determine probable demand. Additional requirements which should not be overlooked include the use of systems analysis applied to problems in water resources and generating local interest in water resources development. (Starr-Chicago)
W69-07451

WATER RESOURCES DEVELOPMENT OF MULLICA RIVER BASIN, NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
James B. Durand, Marvin L. Granstrom, and George H. Nieswand.
OWRR Project B-014-N.J. June 1969. 4 p.

Descriptors: Ecosystems, Aquatic life, Nutrient requirements, Conjunctive use, Systems analysis, Estuary, New Jersey.
Identifiers: *Mullica River Basin, Bay-river system.

The eventual use of the Mullica River basin for water supply will affect the ecosystems in the river-bay complex. Over a period of almost a decade, a biologist group has been observing the physical, chemical, and biological characteristics of the complex. Recently, an engineer group has joined the biologists. The engineers' objectives are to develop methods of orderly planning the optimization of water supply development and minimization of the effect of fluvial water withdrawal on the bay-river system.
W69-07456

THE ECONOMIC IMPLICATIONS OF THE INTERCONNECTION OF URBAN WATER SYSTEMS,
Temple Univ., Philadelphia.
Paul Seidenstat.
Philadelphia, Bureau of Economic and Business Research Occasional Paper no. 2, 1969. 25 p. OWRR-14-01-0001-1976.

Descriptors: *Water supply, *Water utilization, *Water resources development, *Water shortage, Water distribution (Applied), Water management (Applied), Planning, Economic efficiency.

This paper examines the market for water sold by public water systems in the Philadelphia metropolitan area to determine the economic feasibility of water interchange among contingent water systems. Analysis of the supply network and pattern of water use presented in several tables reveals considerable unused capacity at both the raw and treated water levels for many systems; however, a few are plagued by occasional deficiencies. Projections of future use indicate the continuance of much excess supply. The coexistence of 'surplus' and 'deficit' suppliers has led to a practice of tradeoffs - either on an emergency or a continuing basis. Not only are present interconnections economically feasible but there is also considerable potential for future ones. A regional approach to water system development might eliminate much of the apparent economic waste related to excess capacity.
W69-07468

WATER AND THE CITIES: CONTEMPORARY URBAN WATER RESOURCE AND RELATED LAND PLANNING,
Abt Associates, Inc., Cambridge, Mass.
P. Raven-Hansen, J. M. Yudelson, and M. J. White.
Available from Clearinghouse as PB 184 699 at $3.00 in paper copy and $0.65 in microfiche. Cambridge, Massachusetts, Abt Associates, Inc. OWRR Project C-1469. June 30, 1969. 507 p.

Descriptors: *Water pollution control, *Water quality management, *Waterfront land use, *Recreation, Storm water drainage, Combined sewer overflows, Sewer separation, Municipal waste treatment, Chlorination/detention tanks, Holding tanks, Sludge disposal, Urbanization, Hydrologic environment, Systems Analysis.
Identifiers: *Social planning, *Deep tunnel flood and pollution control, *Psychological public goods, Boston, Chicago, Columbia, Detroit, Little Rock, Los Angeles, New Orleans, Pittsburgh, San Antonio, Seattle, Waterfront striplands, Recreation standards, Blue-green drainage planning.

Ten case studies of urban water resources and related land planning are presented, based on interviews with urban planners, citizens' groups, and engineering consultants, and on current planning documents from each city. Water quality management, waterfront land use, water-related recreation and open space, and metropolitan growth are identified as critical problem-areas in planning the interactions of urban activity and the water resource. The lack of feedback from planning engineers to the regulatory agencies which set water quality standards is identified as a major constraint on efficient water qualtiy management and planning. The inability to respond to changing land uses is identified as a major constraint on waterfront land use planning. A neglect of the distributional aspects of urban water recreation development is identified as a constraint on the effectiveness of its planning. Jurisdictional fragmentation and/or competition is identified as a constraint on

the planning and control of metropolitan growth. From the analysis of the planning experience, general guidelines for urban water resources planning in the four problem-areas are formulated in the language of systems analysis.
W69-07479

A STUDY OF THE EXPENDITURES FOR URBAN WATER SERVICES,
Travelers Research Corp., Hartford, Conn.
For primary bibliographic entry see Field 06C.
W69-07483

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

METHODS OF FINANCING STATE PARTICIPATION IN WATER RESOURCES DEVELOPMENT,
Kansas Water Resources Research Inst., Manhattan.
Darwin W. Daicoff.
Contribution No 4, Kansas Water Resources Research Institute, Kansas State University, Research conducted September 1965 - August 1966. 34 p. OWRR B-003KAN.

Descriptors: *Financing, *Cost allocation, Interagency cooperation, Cost-benefit analysis, Taxes, Economic efficiency, Administrative agencies, State jurisdiction, Legal aspects, Federal jurisdiction, Kansas, Texas, Wisconsin.
Identifiers: User charges, Spillover benefits, Local jurisdiction.

The objective is to determine the most efficient revenue system for a water resources development project. Section I, the body of the report, incorporates a discussion of spillover benefits and the cost allocation problems they create into an analysis of the interjurisdictional relationships involved in revenue system. Sub-topics discussed include the problem of choosing an agency to administer the revenue structure; the reasons that financing should be administered by legal coercion rather than voluntary cooperation; the change in state and local roles depending on whether the places of benefit and residence are the same; and the legal precedents for federal supervision of financing found in federal laws and in Kansas laws and policies. Section II, assuming a fixed revenue system examines the way to compose a particular project. The method of benefit-cost analysis is discussed and its proper application to the determination of a project's composition is described. Section III analyzes the relative merits of user charges and taxes, and examines the appropriateness of Texas and Wisconsin revenue procedures. Results show that an 'economically proper' revenue system cannot be constructed because the projects themselves do not use any economic efficiency criterion in determining their composition. (Gossen-Chicago)
W69-07447

A STUDY OF THE EXPENDITURES FOR URBAN WATER SERVICES,
Travelers Research Corp., Hartford, Conn.
LeRoy H. Clem.
ASCE Urban Water Resources Res Program Tech Mem No 7, February 1969. 21 p, 2 tab, 11 ref. OWRR Contract No 14-01-0001-1585. Available from Clearinghouse as PB 184 702 at $3.00 in paper copy and $0.65 in microfiche.

Descriptors: *Municipal water, *Water costs, *Connecticut, Cost analysis, Water sources, Water supply, Storm runoff, Water treatment, Water pollution control, Operating costs, Construction costs, Economics, Water rates.
Identifiers: Hartford (Conn).

A study was undertaken to determine the feasibility of and provide guidelines for analyzing all urban water service costs and to determine their relationship to other local government expenditures, such as education, public works, and law enforcement. The City of Hartford was chosen for the pilot investigation because the manager's fiscal practices were suitable and appropriate records were available, and the cooperation of key city personnel was promised. Total cost of Hartford's water services has decreased from $8.5 million (17.4% of annual city budget) in 1965 to $5.1 million (7.4% of budget) in 1968. The decrease is due to completion of a major storm drainage project. Water sales were nearly constant at about $2.4 million during each of the 4 years under review. The city is the major participant in the local metropolitan water district which also embraces many adjacent towns. Hartford has over the years been subjected to catastrophic flooding from the Connecticut River. Local efforts and the Corps of Engineers have worked in conjunction to eliminate the flooding problem, but the city has low-lying areas requiring storm runoff pumping. At present, the sewerage and storm drainage systems are combined but steps are being taken to separate them. Urban water service costs can be analyzed and their relationship to other local expenditures determined. An approach recommended for nationwide studies is given. (Knapp-USGS)
W69-07483

6D. Water Demand

WATER -- OUR ENGINEERING RESPONSIBILITY,
A. W. Snell.
Agricultural Engineering, Vol 48, No 12, pp 707-709, December 1967. 3 p, 12 ref.

Descriptors: *Water demand, *Water use, *Water quality, Social impact, Political aspects.
Identifiers: Alternative plans.

The main thesis of this article is that while there will be no major national water shortage there will be the problem of distribution in time and space and of preserving a suitable quality. There will be local water shortages caused by dense population with high needs. There will also be conflicts of interest and demand for the same source of water and conflicts which develop because of the effect one user has on the quality for subsequent users. Solving these problems will require that full consideration be given to the prevailing physical characteristics, the economies of the plan, the economies of available alternatives, the effects of each alternative on the social condition of the people, and the political decisions that must be made. (Starr-Chicago)
W69-07450

PROTECTION OF NAVIGABLE WATERS - INVESTIGATIONS CONCERNING EROSION OF SHORES OF COASTAL AND LAKE WATERS.
For primary bibliographic entry see Field 04D.
W69-07655

6E. Water Law and Institutions

APPLICATION OF HUIE (CONDEMNATION AWARDS).

2 A D 2d 786, 154 NYS 2d 242 (1956).

Descriptors: *New York, *Condemnation value, *Withdrawal, *Streams, Judicial decisions, Legal aspects, Compensation, Cities, Recreation, Eminent domain, Relative rights, Rivers.

Claimants own property near a river to which they have recreational rights subject to an intervening riparian owner's right to deplete any or all of the water. Petitioner acquired the riparian interest in order to make use of the river for water supply purposes. The court held that the appraisal commissioner's award of damages to the claimants was excessive in view of the fact that the previous riparian owner could have depleted all of the waters without becoming answerable to claimant. (Molica-Fla)
W69-07264

UNITED STATES EX REL TVA V 137 ACRES OF LAND (PROPER COMPENSATION IN CONDEMNATION PROCEEDING).
406 F 2d 1283-1289 (6th Cir 1969).

Descriptors: *Tennessee, *Tennessee Valley Authority Project, *Condemnation, *Compensation, Road construction, Legal aspects, Judicial decisions, Administrative agencies, Eminent domain, Federal government, Tennessee River, Dams, Reservoirs, Highways, Recreational facilities, State governments, Bridges, Damages, Flooding, Ditches, Parks, River Basin development, Contracts, Condemnation value, Roadbanks.

In an action for condemnation of certain lands for use by the Tennessee Valley Authority, the lower court awarded the landowners $34,000 and they appealed. Prior to the taking by the TVA, the State of Tennessee had taken a 12-acres plot of the land in question in order to build a highway. The highway project increased the value of the land since it was made suitable for restaurants, motels, and other purposes. The landowners contended that the enhancement in value of the property brought about by the highway project should inure to their benefit rather than to the TVA. TVA contended that their project brought about establishment of the interchange and that the landowners should not be entitled to any enhancement in value. The court found that the enhancement in value was not brought about by the proposed dam, but by the proposed state highway improvement. The court held that the burden of proving that the project brought about the enhanced value of the land was on TVA and that it failed to meet this burden. The court held the landowners were entitled to the value of their land on the date of the taking. The court found that the highway project was planned prior to the TVA's taking and thus held the landowners entitled to an award of $97,500. (Shevin-Fla)
W69-07265

THE MARINE ENVIRONMENT -- RECENT LEGAL DEVELOPMENTS,
Oliver L. Stone.
Nat Resources Lawyer, Vol 11, No 1, pp 26-46, Jan 1969. 21 p, 25 ref.

Descriptors: *United States, *United Nations, *International law, *Submerged lands act, Conjunctive use, Texas, Louisiana, Alabama, Florida, Gulf of Mexico, Atlantic Ocean, Oceans, Mineralogy, Continental shelf, Continental slope, Continental margin, Coasts, Coastal plains, Beds under water, Ownership of beds, Oil industry, Exploitation, Legal aspects, Usufructuary right, Judicial decisions, Reasonable use, Navigable waters, Harbors, Bays, Offshore platforms, Riparian land, Littoral, Subsoil, Subsurface investigations, Drilling.

There has been an upsurge in the number of recent legal developments concerning marine environment. Interest is being focused internationally upon the question of the seaward limit of the continental shelf regime embodied in the Geneva Convention on the continental shelf as well as the issue of what legal regime applies or should apply to the suboceanic resources beyond the continental shelf regime. On the domestic side, recent cases have arisen involving where the coast line of individual states is to be measured from under the Submerged Lands Act. Questions of state sovereignty over reefs lying within the contiguous zone of twelve miles but beyond the traditional three-mile limit arose in a recent Florida case. These issues are discussed in detail. (Katz-Fla)
W69-07266

THE MARINE ENVIRONMENT -- RECENT LEGAL DEVELOPMENTS,
Oliver L. Stone.
Nat Resources Lawyer, Vol 11, No 1, pp 26-32, Jan 1969. 21 p, 25 ref.

Descriptors: *United States, *United Nations, *International law, *Submerged lands act, Texas, Florida, Louisiana, Alabama, Gulf of Mexico, Atlantic Ocean, Oceans, Mineralogy, Continental shelf, Continental margin, Coasts, Coastal plains, Beds under water, Ownership of beds, Oil industry, Exploitation, Legal aspects, Usufructuary right, Judicial decisions, Reasonable use, Navigable waters, Harbors, Bays, Offshore platforms, Riparian land, Subsoil, Subsurface investigations, Drilling, Conjunctive use, Legislation, Structures.

The supreme court, in United States v Louisiana, held that under the Submerged Lands Act a state may claim a seaward boundary to a three-mile point from its coastline or may claim a coastline based on its historic boundary. An historically based coastline must be measured as it existed on the date of the claimant state's entry into the Union. Under the Convention on the Territorial Sea a bay is delineated by the semicircle test. This test, accepted by the United States, requires that a bay comprise at least as much water area within its closing line as would be contained in a semicircle with a diameter equal to the length of the closing line. In United States v Ray, certain parties asserted the right to erect a structure on reefs located ten miles off the Florida coast. The court, in enjoining the defendants from further activity, noted that the seabed of the outer continental shelf adjacent to the United States appertains to the state and is subject to federal control, jurisdiction and power of disposition. (Katz-Fla)
W69-07267

THE MARINE ENVIRONMENT – RECENT LEGAL DEVELOPMENTS,
Oliver L. Stone.
Nat Resources Lawyer, Vol 11, No 1, pp 32-43, Jan 1969. 21 p, 25 ref.

Descriptors: *United States, *United Nations, *International law, *Submerged lands act, Texas, Florida, Alabama, Louisiana, Reefs, Gulf of Mexico, Atlantic Ocean, Oceans, Structures, Coasts, Legislation, Mineralogy, Continental shelf, Continental margin, Coastal plains, Beds under water, Ownership of beds, Oil industry, Exploitation, Legal aspects, Usufructuary right, Judicial decisions, Reasonable use, Navigable waters, Harbors, Bays, Offshore platforms, Riparian land, Littoral, Subsoil, Subsurface investigations, Drilling.

The Marine Resources and Engineering Development Act authorizes various studies to be undertaken relating to marine resources. A recent study suggests redefining the continental shelf, ending it at the 200 meter isobath with a buffer zone of 'x' miles being established between the 200 meter line and the deep sea. The coastal state would leave exclusive rights of exploitation within the buffer zone. The existing shelf regime accepted by 39 nations presently extends beyond the 200 meter isobath and it is questionable that these states would be willing to surrender 'vested' rights. The National Petroleum Council recently concluded that coastal states have exclusive jurisdiction over the natural resources of the continental land mass seaward to where the submerged portion of the land mass meets the abyssal ocean floor. The NPC stated that an urgency to develop a regime for the ocean floor beyond national jurisdiction does not presently exist. The author concludes that the Marine Sciences Commission report will greatly reduce the uncertainty concerned with developing a regime for the ocean floor beneath the high seas. (Katz-Fla)
W69-07268

THE MARINE ENVIRONMENT – RECENT LEGAL DEVELOPMENTS,
Oliver L. Stone.
Nat Resources Lawyer, Vol 11, No 1, pp 43-46, Jan 1969. 21 p, 25 ref.

Descriptors: *United States, *United Nations, *International law, *Submerged Lands Act, Texas, Louisiana, Alabama, Florida, Gulf of Mexico, Atlantic Ocean, Oceans, Mineralogy, Continental shelf, Continental slope, Continental margins, Coasts, Coastal plains, Beds under water, Ownership of beds, Oil industry, Exploitation, Legal aspects, Usufructuary right, Judicial decisions, Reasonable use, Navigable waters, Harbors, Bays, Offshore platforms, Riparian land, Littoral, Subsoil, Subsurface investigations, Drilling.

The Maltese Mission to the United Nations recently proposed that the General Assembly should consider the propriety of making a declaration reserving the seabed and ocean floors beneath the high seas exclusively for peaceful purposes and uses. Such a declaration would not effect waters presently under national jurisdiction. The proposed declaration envisages a treaty which would create an international agency. This agency would act as trustee for all nations over the seabed and ocean floor beyond national jurisdiction. This proposal prompted domestic action in the United States Senate generally in accord with the Maltese proposal, but no definitive action was undertaken by the 90th Congress. The United Nations, in response to the Maltese proposal, has created a Committee of Nations to study the proposal. The Committee failed to reach consensus on the principles to be applied to the proposal. However, the Committee did agree that the area in question will be used only for peaceful purposes and in the interest of mankind. It is also agreed that the rights of coastal states will be respected. If proved impossible to agree to a delineation of the area in question. (Katz-Fla)
W69-07269

WILFUL OBSTRUCTION TO NAVIGATION.
Conn Gen Stat Ann secs 53-93, 53-110, 53-112, 53-136 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Alteration of flow, *Bridges, *Fisheries, Navigable waters, Canals, Gates, Locks, Banks, Dams, Aqueducts, Piers, Fish hatcheries, Fish conservation, Farm ponds, Damages, Burning, Flumes, Diversion, Cities, Water supply, Utilities, Navigation, Lumber.
Identifiers: (Obstruction to navigation, Penalties (Criminal), Water meters.

Any person who wilfully obstructs the navigation of any canal or opens or shuts any gate or lock of the canal or does any damage to the canal, may be fined and/or imprisoned. No person shall be permitted to trespass upon or remove fish from any hatchery controlled by the State Board of Fisheries and Game without permission from that body. No person shall damage appliances used by the Board or damage any pond, dam, receptacle or fence used by the Board. Violators are subject to fine. Any person maliciously injuring any bridge, lock, dam, or wood of another may be fined and/or imprisoned. Any person who, with intent to defraud, diverts water from another, a water company, or a municipality, or defrauds the meter measuring his consumption of water shall be subject to fine and/or imprisonment. (Shevin-Fla)
W69-07270

SHELLFISH.

Conn Gen Stat Ann secs 19-52 to 19-59 (1960).

Descriptors: *Connecticut, *Shellfish, *Public health, *Pollutants, Legislation, Clams, Commercial shellfish, Mussels, Oysters, Regulation, Baits, Population, Boats, Permits, Shores, Tidal waters, Cities, Commercial fishing, Fish harvest, Docks.
Identifiers: Notice, Penalties (Criminal), Transplantation (Shellfish).

The word 'shellfish' means mussels, oysters, and all varieties of clams. The State Board of Health may inspect shellfish beds, boats, appliances used in preparation of shellfish for market, and all wharves and buildings where shellfish are prepared for shipment or sale. The Board may prescribe regulations for growth, production, and preparation of shellfish for market. All persons dealing in shellfish must obtain certificates of identification, and the Department may require that all shipments be marked in such a way as to identify the shipper. Certification may be revoked after a hearing and upon showing of cause. Any person whose certificate has been revoked may appeal to the county court. The Department may prohibit the taking of shellfish from certain areas which it deems contaminated; however, cities may allow the taking from that area for use as bait. The Department, upon contaminating an area, must publish notice in the local newspapers, file notice in the local department of health, and post notice at the designated area. Any person violating any provisions of the section may be fined or imprisoned. Persons may remove shellfish from contaminated areas and transplant them in approved areas after they have been authorized to do so by the department of health. (Shevin-Fla)
W69-07271

ELIMINATION OF MOSQUITO-BREEDING PLACES.

Conn Gen Stat Ann secs 19-50, 19-51 (1960), as amended, (Supp 1968).

Descriptors: *Connecticut, *Public health, *Mosquitoes, *Swamps, Legislation, Bogs, Coastal marshes, Drainage wells, Marshes, Stagnant water, Larvae, Drains, Landfills, Damages, Ditches, Canals, Regulation.
Identifiers: Tidegates, Breeding, Penalties (Criminal).

The Commissioner of Health may make regulations concerning the elimination of mosquitoes and may enter any swamp, marsh, or land to determine if it is a breeding place and order it drained or filled to eliminate the insects. Notice of the area affected and the operation to be carried out must be published in the town where the land is located, and the owners must be notified by registered mail. The Commissioner shall assess the damage caused to the property and file his assessment in the county court. Any person aggrieved by the plan or the assessment may file for relief in the county courts. When any area has been drained by the Commissioner, he shall keep the area in repair and free from obstruction and make such repairs as will make the work effective. Any person obstructing the work of the Commissioner in so treating mosquito breeding areas shall be subject to fine or imprisonment. (Shevin-Fla)
W69-07272

RAILROADS.

Conn Gen Stat Ann secs 16-82, 16-95, 16-134 (1958).

Descriptors: *Connecticut, *Railroads, *Canals, *Highways, Legislation, Construction, Bridges, Navigable waters, Nonnavigable waters, Transportation, Streams, Bridge construction, Alteration of flow, Highway relocation, Watercourses (Legal), Channels, Design flow, Structures, Boats, Regulation.

Companies may alter the location of its road in order to add to the number of its main tracts and, for that purpose, may take additional land. If an additional bridge over navigable water is required to add to the main track, it shall be constructed according to specifications set by the railroad commission. When railroad construction must intersect a nonnavigable watercourse or public highway, the company must obtain approval of the commission to construct across it. The company must restore the watercourse or highway to its former state and not impair its usefulness. If construction across a highway cannot be done without damage to the highway, the company may, with the approval of the commission, change or alter the highway, but the highway must be maintained in as good a condition as it was before the alteration. The commission may order the location of a canal or watercourse

changed in order to allow the railroad to be more advantageously constructed. The flow of water in a changed watercourse cannot be impaired, and the expense of making necessary changes in order to maintain the watercourse must be borne by the railroad. The section does not apply to canals maintained in a condition of navigation. (Shevin-Fla)
W69-07273

HARBORS AND RIVERS ACT OF CONNECTICUT.
Conn Gen Stat Ann secs 15-13 to 15-16 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Harbors, *Permits, Navigable waters, Navigation, Federal jurisdiction, Ships, Boats, Channels, Legal aspects, Navigable rivers, Legislation, Regulation.
Identifiers: *Pilots.

The superior court of any county adjoining navigable waters may license as many residents of the state as the court deems necessary to act as pilots in the state's waters. The applicants must already hold a license from the authorized federal agency. Applicants must serve an apprenticeship, during which period they shall observe and assist docking by licensed pilots. Applicants must be bonded. Generally, the superior court of any county shall, upon application, fix the rates of pilotage in the waters of that county. All inward and outward bound vessels of foreign bottom and American vessels under register, drawing nine or more feet of water must take a licensed pilot when entering or leaving a state port. Coastal trading American vessels and certain fishing vessels are exempt from this requirement. The commander of any vessel, wholly or partly propelled by power, which travels at a greater rate than six miles per hour when approaching or passing anchored vessels or specified piers and wharves, shall be liable for fines and treble damages for injury which the vessel causes. (Kelly-Fla)
W69-07274

HARBORS AND RIVERS ACT OF CONNECTICUT.

Conn Gen Stat Ann secs 15-8 to 15-12 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Harbors, *Navigation, *Coastal structures, Ships, Boats, Legal aspects, Piers, Docks, Piles (Foundations), Legislation, Channels, Channel flow, Barriers, Navigable rivers, Navigable waters, Regulation.

The harbor master may station under his care all vessels at anchor in the harbor channel and vessels so moored that they may be carried into the channel. The master may remove vessels which, in his judgment, will obstruct navigation, and he may decide to what place in the harbor such vessel should be removed. Any person willfully refusing or neglecting the order of a harbor master subjects himself to possible fines and assessment of costs of removal and legal expenses. A harbor master may be fined and charged expenses for neglecting to remove a vessel obstructing its channel upon application of a person engaged in navigation of the harbor under the master's charge. Owners or occupants of land adjoining any navigable waters, except New Haven and Bridgeport harbors, may dig channels to give vessels free access from wharves or piers on their land to the main channel. No interference with, or obstruction on, land bordering navigable waters will be permitted where the public has the right of access unless the landowner has given permission or there is other legal right to do so. (Kelly-Fla)
W69-07275

HARBORS AND RIVERS ACT OF CONNECTICUT.
Conn Gen Stat Ann secs 15-1 to 15-7 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Navigable waters, *Harbors, Coastal structures, Piers, Docks, Piles (Foundations), Navigation, Coasts, Channels, Ships, Boats, Legal aspects, Legislation, Regulation.

The governor of Connecticut is authorized to appoint a harbor master and a deputy harbor master for each of the harbors of New Haven, Norwich, Bridgeport, Stamford, Norwalk, Stonington, New London, and Branford for terms of three years. Other harbor masters and deputies may be appointed for any town having navigable waters within its limits. Deputy harbor masters have all the powers of harbor masters in the harbors to which they are appointed, subject to the control and direction of harbor masters. Jurisdictions of the harbor masters for Branford and New Haven are extended to adjoining waters. Fines are prescribed for vessels unnecessarily moored in the New Haven channel so as to obstruct the free passage of vessels. The Bridgeport Harbor Master is responsible for supervision of the harbor, tidewaters, all flats and lands flowed thereby, and for removal of obstructions which may interfere with navigation, cause injury to channels, or reduce tidewaters. The harbor master must approve construction of bridges, wharves, piers, dams, fills, or any driving of piles below the high water mark. Unapproved construction shall be deemed by the master a public nuisance, subject to appeal. (Kelly-Fla)
W69-07276

HARBORS AND RIVERS ACT OF CONNECTICUT.
Conn Gen Stat Ann secs 15-1 through 15-26 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Navigable waters, *Navigation, Structures, Harbors, Coastal structures, Boats, Ships, Permits, Channels, Channel flow, Navigable rivers, Piers, Docks, Piles (Foundations), Lighthouses, Water pollution sources, Legal aspects, Legislation, Federal jurisdiction, Coasts, Barriers, Channel flow, Landfills.

The Harbors and Rivers Act of Connecticut provides that harbor masters for specified state harbors and other navigable waters will be selected by the governor. The duties and powers of the harbor masters and their deputies are set forth, and provision for appeal from their decisions is made. Penalties for disregarding directives given by the masters are established. The statute further provides for the qualifications and licensing of pilots for vessels within the navigable waters of the state. Depositing and dumping in navigable waters is generally prohibited by the statute and penalties are provided. (Kelly-Fla)
W69-07277

HARBORS AND RIVERS ACT OF CONNECTICUT.
Conn Gen Stat Ann secs 15-17 to 15-26 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Harbors, *Navigable waters, Navigation, Navigable rivers, Piers, Docks, Piles (Foundations), Landfills, Legal aspects, Legislation, Water pollution sources, Coastal structures, Channels, Barriers, Boats, Ships.

Proprietors or charterers of steamers or other vessels will be subject to fines if furnace refuse from their vessels is thrown into any harbor or river of the state. Obstructions or structures placed in New Haven Harbor without the consent of the board of harbor commissioners may be removed by the board at the owner's expense if the latter fails to remove it under the board's order. No wharf, pier, or other structure may be constructed in specified areas of New Haven Harbor. A party contesting an order by the New Haven Board regarding construction or filling in the harbor may appeal the order to the court of common pleas of New Haven County. Dumping of any substance, except oyster shells, in New Haven Harbor, or near its mouth, is prohibited. Dumping is also disallowed in other harbor areas specified by the statute. Fines will be imposed for removal or destruction of any authorized buoy, beacon or floating guide in the waters of Connecticut. Mooring or attaching any vessel to such marker is also prohibited. Local agents of foreign vessels must meet state residency requirements. (Kelly-Fla)
W69-07278

SEWAGE TREATMENT.
W Va Code Ann secs 16-12-5, 16-12-6 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Public health, *Sewage disposal, *Sewage districts, Legislation, Sewage, Municipal wastes, Cities, Pumping plants, Sewage treatment, Sewers, Water pollution sources, Septic tanks, Environmental sanitation, Water pollution treatment, Channels, Drainage systems, Drains, Social aspects, Wildlife, Water purification, Water quality, Water quality control, Lakes, Watercourses (Legal), Water supply, Construction, Water delivery, Administrative agencies, Structures, Boundaries (Surfaces).
Identifiers: Penalties (Criminal).

The board of trustees of any sewage district has the authority to construct and defray costs of providing for the disposal of sewage and drainage within the district. The board is charged with protecting the water supply from contamination and for that purpose may build and maintain a sewage treatment plant together with any other appurtenances necessary to achieve that purpose. The works established by the district must serve and benefit the entire territory within the district. Nothing in this article shall limit the power of municipalities within the district to construct their own drains and sewers. If any structure operated by the district extends outside the district, the rights and powers of the district over that portion shall be the same as those within the district. The board may treat and purify water which will flow into any watercourse, but it may not operate a waterworks for furnishing water to any municipality. All districts created shall proceed as rapidly as possible to provide sewers and plants to purify water so as to conduce preservation of public health and render the sewage harmless to animal, fish, and plant life. Any violation by the district will be a misdemeanor and a fine will be levied. It is the duty of the state water resources board or the state department of health to see that these provisions are carried out. (Shevin-Fla)
W69-07279

NATURAL RESOURCES -- SURFACE MINING.

W Va Code Ann secs 20-6-1, 20-6-9, 20-6-11, 20-6-12, 20-6-13 (Supp 1968).

Descriptors: *West Virginia, *Mining, *Natural resources, *Land reclamation, Conservation, Legislation, Administrative agencies, Jurisdiction, State governments, Federal government, Permits, Soil erosion, Aesthetics, Recreation, Public health, Floods, Land use, Water pollution, Mining engineering, Land development.
Identifiers: *Surface mining.

The department of natural resources has jurisdiction and control over all aspects of surface mining, especially the restoration of affected areas. It was discovered that surface mining causes soil erosion, landslides, flooding, pollution, and destroys the land value for agricultural, recreational, and aesthetic purposes. In addition, it counteracts conservation efforts and impairs the health, safety, and welfare of the public. The director of natural resources may avail himself of the services of any state or federal agency. A surface mining operator is required to prepare a complete reclamation plan and submit it to the director for acceptance. No permit application will be approved if it is felt that the rules and regulations will not or cannot be observed. Some areas are impossible to reclaim and no mining will be allowed on them. The director

may also delete any lands which have been overburdened by prior surface mining. He is given considerable discretion to prohibit use of certain lands for surface mining operations. It is the duty of the mining operator to complete reclamation within one year after his permit has expired. (Stewart-Fla)
W69-07280

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-07281

FORESTS AND WILDLIFE AREAS.

W Va Code Ann secs 20-3-2, 20-3-18 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Flood control, *Land management, *Wildlife conservation, Forest management, Legislation, Dams, Administrative agencies, Conservation, Forests, Road construction, Federal government, Regulation, Navigation, Local governments, Legal aspects.

The director of the wildlife commission may, with the governor's consent, purchase lands suitable for state forests or wildlife refuges. He may also use the allocated funds to construct dams for fish refuges on the acquired lands. Without gubernatorial consent, the director shall pay not more than twenty-five dollars per acre. He may receive the land as a gift by deed or bequest. The title to all such property shall be in the name of the state. The director shall protect and maintain the land as forest and wildlife areas. In addition, he may prescribe and enforce rules and regulations concerning hunting and fishing on the property. Money received from the federal government for flood control or navigation purposes shall be allocated to the counties. 50% of each county's funds shall be transferred to the road commission to maintain feeder or state local service roads in the counties where floods are located. (Stewart-Fla)
W69-07282

WATER RESOURCE DEVELOPMENT.
W Va Code Ann secs 20-5-1 through 20-5-5 (1966), as amended, (Supp 1968).

Descriptors: *West Virginia, *Administrative agencies, *Water resources development, *Water conservation, Legislation, Water pollution, Federal government, State governments, Natural resources, Planning, Water policy, Water supply, Interstate compacts, Watercourses, Investigations, Domestic water.

The state water resources board, established as a successor to the state water commission, is a public corporation. It can sue and be sued, contract and be contracted with. The board has jurisdiction over the Ohio River Valley Sanitation Commission. The division of water resources has jurisdiction over the administration and enforcement of all laws relating to the conservation, development, protection, and enjoyment of the state water resources. The chief of the division of water resources shall investigate the water resources of the state and study the problems of agriculture, industry, conservation, water pollution, domestic use, and other problems related to water resources. He shall formulate plans and policies for the preservation of water resources. The chief is authorized to request information from any state agency or political subdivision to help him obtain a more accurate picture. He may also cooperate with state and federal agencies. The water resources board has authority to enter into compacts with neighboring states regarding common watercourses. The board and its authorized representatives are empowered to enter any public or private property to conduct surveys or investigations. (Stewart-Fla)
W69-07283

POLLUTION ABATEMENT (POWERS AND DUTIES OF DEPARTMENT OF WATER RESOURCES).
For primary bibliographic entry see Field 05G.
W69-07284

MARYLAND DEPARTMENT OF WATER RESOURCES: POWERS AND FUNCTIONS.
Md Ann Code, art 96A:6-9 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Water resources development, *Programs, *Multiple-purpose projects, Legislation, Water resources, Administrative agencies, State governments, Multiple purpose, Project planning, Long-term planning, Boundaries (Property), Investigations, Surveys, Research and development, Research facilities, Tidal waters.

The Maryland Department of Water Resources shall be responsible for supervising and planning the multiple purpose development of state waters, and shall prepare a general water resources program in a manner compatible with multiple purpose management on an appropriate geographical unit basis. The Department is authorized and empowered to make surveys, maps, investigations, and studies of state water resources as it may deem necessary to provide it with sufficient information to formulate a program and to perform its duties. The Department is further authorized to contract for research or scientific investigation with appropriate research organizations. The Department may conduct a joint study with the State Departments of Game and Inland Fish and Chesapeake Bay Affairs in order to define the boundaries of tidal and nontidal waters within state jurisdiction. The boundaries determined shall be set forth in Department regulations. In addition, the Department shall exercise those responsibilities reasonably necessary in carrying out legislative intent. (Wheeler-Fla)
W69-07285

SOIL CONSERVATION.
Conn Gen Stat Ann secs 25-106 to 25-109b (1960), as amended, (Supp 1969).

Descriptors: *Connecticut, *Watershed management, *Flood protection, *Conservation, Legislation, Fish conservation, Wildlife conservation, Water law, Interstate compacts, Recreation facilities, Cities, Agriculture, Governors, Government finance, Multiple-purpose projects, Watersheds (Basins), Cities.
Identifiers: Secretary of Agriculture.

The term 'works of improvement' is defined as any single or multi-purpose undertaking for flood prevention or water conservation which includes fish, wildlife and recreational developments in watershed areas not exceeding 250 thousand acres. A watershed area program may be initiated by the legislative body of any municipality requesting the state commissioner of agriculture to review the plan and obtain assistance from the federal secretary of agriculture pursuant to Public Law 566. The commissioner may acquire lands by purchase or eminent domain and may borrow funds from the secretary of agriculture to finance the local share of costs. The commissioner shall control the construction, operation, and maintenance of such works and improvements and shall retain title to any structure exclusive of recreational, fish, and wildlife developments. The state will absorb the cost of relocating any public service company deemed necessary to accommodate any works of improvement. With approval of the governor, the commissioner of agriculture and natural resources may enter into any interstate compact which will facilitate any works of improvement on streams without the state. Municipalities may acquire part of any works of improvement for park and recreational purposes. (Holt-Fla)
W69-07286

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION.
For primary bibliographic entry see Field 05G.
W69-07287

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-07288

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-07289

WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
W69-07290

NOTICE; RIPARIAN OWNER AFFECTED BY TAKING OF WATER.

W Va Code Ann sec 54-2-3 (Supp 1968).

Descriptors: *West Virginia, *Riparian land, *Riparian rights, *Condemnation, Legislation, Riparian water loss, Riparian waters, Compensation, Condemnation value, Damages, Land tenure, Adjudication procedure, Appropriation, Water utilization.
Identifiers: *Notice.

If water is to be taken as authorized in Section Ten, Article One of this chapter, notice to all riparian owners below the point at which the water is proposed to be taken, and who are likely to suffer injury as a result of such taking, must be given by appropriate publication throughout the county. Any riparian owner may make himself a party to the proceedings. He is entitled to have his rights passed upon by the commissioner and his damages, if any, ascertained, allowed, and paid. (Shevin-Fla)
W69-07291

BRIDGES.

Minn Stat secs 441.01, 441.15, 441.16, 441.26 to 441.27, 441.46 to 441.48 (1947),as amended, (Supp 1969).

Descriptors: *Minnesota, *Bridges, *Cities, *Construction, Local governments, Navigable waters, Nonnavigable waters, Legislation, Boundaries (Property), Bridge construction, Watercourses, Municipalities, State governments, Administrative agencies, Maintenance, Repairing.

Any first class city is authorized to construct a bridge jointly with another first class city over any natural watercourse forming a boundary between them. Any first class city having navigable waters and under a home rule charter, is authorized to apply to the Secretary of War for the privilege of erecting a public bridge. Any city whose population is less than 20,000 and which is situated on interstate or international waters is authorized and empowered to secure money by bonds or appropriation for the construction and maintenance of bridges over such waters into another state or country. The council of any fourth class city may appropriate reasonable sums to improve and maintain bridges and ferries on roads leading into the city although located outside the county. Any city purchasing any such bridge has power to sell, assign, and transfer it and its approaches to the state or any political subdivision thereof, or any public or state agency. However, any sale or transfer shall not alter or affect the rights, powers, and securities of any bondholders. Any city bordering on navigable or non-navigable waters is authorized to purchase or construct bridges across such waters whether the bridge is within or beyond the city limits. (Stewart-Fla)
W69-07292

PARK DISTRICTS.
Minn Stat Ann secs 398.01, 398.09, 398.32, 398.34 (2) (1968), as amended, (Supp 1969).

Descriptors: *Minnesota, *Local governments, *Parks, *Administrative agencies, Cities, Land use, Conservation, Natural resources, Recreation, Recreation facilities, Condemnation, Streams, Lakes, Regulation, Federal government, Project purposes, Public benefits, Public health, Mosquitoes, Water pollution, Legislation, Water utilization, Lake shores.

Subject to activation by the Boards of County Commissioners, park districts are created. When activiatied, such districts shall be deemed political subdivisions of the state. The park districts shall be either single or multi-county. The park district boards have the power to regulate the use of any lake waters and shore area in the parks. The board is empowered to acquire lands for conservation of state natural resources including streams, lakes, and submerged lands. The Board does not have the power to acquire land located within the boundaries of a city by purchase or condemnation without prior permission. Neither shall the Board have the power to alter, fix, or charge fees for use of the park. The Board shall not cooperate with or borrow from any state or federal organization. The Board has no authorization to cooperate with any city, county or private organization engaged in conservation, recreation, prevention of water pollution, protection of public health and safety, or mosquito abatement. Any county may acquire any land or water areas deemed useful for public park purposes. The county board may prescribe regulations for protection and use of any parks including waters lying within such park. (Stewart-Fla)
W69-07293

WATER POLLUTION CONTROL; SANITARY DISTRICTS WATER POLLUTION CONTROL ACT.
For primary bibliographic entry see Field 05G.
W69-07294

POLLUTION CONTROL AGENCY.
For primary bibliographic entry see Field 05G.
W69-07295

WATERS AND WATER CRAFT SAFETY.
Minn Stat, secs 361.01 to 361.29 (1966), as amended, (Supp 1969).

Descriptors: *Minnesota, *Permits, *Equipment, Boats, Safety, Water skiing, Legislation, Pollution, Abatement, Water sports, Navigation, State governments, Beaches, Taxes, Foreign countries, Navigable waters, Structures, Financing, Administrative regulation.
Identifiers: Marine toilets, Penalties, Crimes.

All watercraft operated within the state must be licensed. Licensing provisions and fees are set out. Operating regulations including speed, methods of operation, places of operation, water skiing and touring requirements, prohibitions against operating watercraft while intoxicated and accident reports are provided. Equipment requirements are listed. Violation of regulations or equipment requirements is a misdemeanor. The county sheriff has the duty of enforcing the regulations of this chapter. License fees under this chapter shall be paid into the boat and water safety account hereby created. Fines shall be paid the county treasury. Provisions for use of marine toilets are set out. (Kahle-Fla)
W69-07296

WATERS AND WATERCRAFT SAFETY.

Minn Stat sec 361.03 (1966), as amended, (Supp 1969).

Descriptors: *Minnesota, *Permits, Boats, Ships, Legislation, Federal government, State governments, Foreign countries, Navigation, Navigable waters, Taxes, Regulation.

Any watercraft operated within this state must be licensed. Application for license must be made to the commissioner or county auditor according to his regulations. The fees for a license for one calendar year are as follows: (a) rented watercraft 75 cents; (b) watercraft 16 feet or under 75 cents, and an additional 25 cents per foot over 16 feet; (c) dealer's license $5 regardless of the number of craft. Duplicate licenses may be obtained for 75 cents. Licenses expire on December 31 of each year. Licenses shall be issued to stateowned craft without a fee. No license is required for the following craft: (a) craft federally licensed or licensed by another state which have not been in the state for 90 consecutive days; (b) watercraft from another country temporarily using state waters; (c) watercraft owned by the United States or a state; (d) a ship's lifeboat; or (e) craft which have a valid marine document issued by the federal bureau of customs. No political subdivision of the state shall require a watercraft license. (Kahle-Fla)
W69-07297

WATERS AND WATERCRAFT SAFETY.
Minn Stat secs 361.04 to 361.13 (1966), as amended, (Supp 1969).

Descriptors: *Minnesota, *Boats, *Safety, Water skiing, Water sports, Navigation, Navigable waters, State governments, Legislation, Beaches, Regulation.
Identifiers: Obstruction to navigation.

The operation of watercraft at excessive speed or in a careless manner is a misdemeanor. Reckless operation causing injury or property damage is punishable by a fine of not more than $100 and/or imprisonment not to exceed 90 days. Operating watercraft so as to obstruct navigation or the placing of structures on water for advertising are prohibited. No watercraft may be operated in areas set aside for bathing. No person may operate a watercraft towing a person on skis or other devices without another person in the boat to observe the skier or without being equipped with a curved rearview mirror to observe the skier. No watercraft shall be operated when loaded beyond its safe capacity or equipped with a motor beyond its safe power capacity. It is unlawful to ride on the gunwales or bow of a boat under 26 feet unless the boat is equipped with adequate safety railing. No person shall operate a watercraft while under the influence of alcohol. An operator involved in an accident must render assistance and promptly report the accident to the sheriff. Where penalty is not specifically set out, violation shall be a misdemeanor subject to $100 fine and/or 90 days imprisonment. In addition, violators may be prohibited from operating a watercraft for 90 days. (Kahle-Fla)
W69-07298

WATERS AND WATERCRAFT SAFETY.

Minn Stat secs 361.14 to 361.27 (1966), as amended, (Supp 1969).

Descriptors: *Minnesota, *Boats, *Ships, *Safety, Equipment, Legislation, State governments, Local governments, Navigation, Navigable waters, Structures, Financing, Regulation.

Rental watercraft shall have available life preservers complying with Coast Guard regulations if the county board approves such regulation. Watercraft under 26 feet must carry a light visible for 2 miles. Craft over 26 feet must comply with Coast Guard lighting regulations. Boats over 26 feet must carry a horn or whistle audible for at least 1/2 mile. No siren shall be carried by other than patrol boats. All craft must be equipped with a muffler. No motor other than an outboard shall be used without a device for arresting backfire. Boats using fuel must be equipped with a fire extinguisher. Races or exhibitions must have approval of the county sheriff. Permits from the commissioner are required for structures which may constitute navigational hazards. No person shall tamper with a navigational aid. Violations of the above provisions are punishable by $100 fine and/or 90 days imprisonment. In addition violators may be prohibited from operating a watercraft for 90 days. The sheriff shall enforce provisions of this chapter and maintain a search and rescue program. County boards shall propose budgets for carrying out provisions of this chapter which shall be incorporated into the budget of the department of conservation subject to the commissioner's approval. License fees shall be paid into the boat and water safety account hereby created. Fines shall be paid to the county treasury--one half to be applied to county revenue and one half to the boat and water safety account. (Kahle-Fla)
W69-07299

WATERS AND WATERCRAFT SAFETY.
Minn Stat sec 361.29 (1966), as amended, (Supp 1969).

Descriptors: *Minnesota, *Pollutants, *Pollution abatement, Boats, Ships, Navigable waters, Permits, Legislation, State governments, Regulation.
Identifiers: Marine toilets, Human excrements.

No person operating a watercraft shall permit the use of a marine toilet unless it is equipped with a treatment device acceptable to the water pollution control commission of the state. No person shall discharge untreated sewage or other waste into the waters of the state. The water pollution control commission shall furnish a list of acceptable marine toilets. After April 1, 1966 no craft shall be equipped with any marine toilet unless acceptable to the commission. Presence of a marine toilet must be indicated upon application for licensing and no license shall be issued except upon certification by the owner of installation of an acceptable treatment device. (Kahle-Fla)
W69-07300

HANCOCK V PIPER (CONSTRUCTION OF A DRAINAGE CANAL).

219 So 2d 746-48 (2d DCA Fla 1969).

Descriptors: *Florida, *Drainage, *Road construction, *Condemnation, Canals, Right of way, Easements, Engineers, Ditches, Damages, Construction, Legal aspects, Judicial decisions, Local governments, Contracts.
Identifiers: Inverse condemnation, Consideration, Failure of consideration.

Appellees, on request of the county, executed a quit claim deed granting the county a 100 foot right of way through their property for the purposes of building a shallow canal for drainage, to be constructed in connection with a proposed road. The county constructed the road but did not complete construction of the drainage canal. The property owners brought an action against the county for its failure to complete the drainage canal. The court held that the complaint filed by the appellees was broad enough to support the decision reached by the trial judge. The court further held that consideration had existed, but that there had been a failure of consideration. The court held that the trial judge properly tried the case under the theory of inverse condemnation and upheld that determination. (Shevin-Fla)
W69-07301

USSERY V ANDERSON-TULLY CO (OWNERSHIP OF LAND FORMED BY ACCRETION).

122 F Supp 115-133 (E D Ark 1954).

Descriptors: *Accretion (Legal aspects), *Land tenure, *Navigable rivers, *Bank erosion, Altera-

tion of flow, Avulsion, Judicial decisions, Arkansas, River beds, Maps, Charts, Lakes, Channels, Riparian lands, Migration, Lumber, Banks, Navigable waters, Land forming, Boundaries (Property), Shores, Legal aspects.
Identifiers: *Arkansas River.

The plaintiff brought suit to quiet his title to certain land formed by accretion. The defendant counterclaimed to quiet his title. The defendant owned property on the north bank of the river while the plaintiff's property was on the south side. The crucial issue to be resolved was which bank of the river was the source of the accretion. The plaintiff contended that the land in question was an accretion to his property but was subsequently cut off by avulsion. Of great persuasive value during the court's deliberations was the physical evidence on the ground and certain evidence demonstrating the growth pattern of timberlands. Also relying on government surveys, the court found that the river migrated southward, destroying the south bank by erosion. The result of the migration and erosion was the formation of the accretion on the north bank. On the basis of this analysis, the court decided in favor of the defendant and quieted title in him. (Stewart-Fla)
W69-07302

GULF ATLANTIC TRANSPORTATION CO V BECKER COUNTY SAND AND GRAVEL CO (SUIT FOR DAMAGES CAUSED BY SHOAL IN NAVIGABLE RIVER).

122 F Supp 13-19 (E D N C 1954).

Descriptors: *North Carolina, *Navigation, *Shoals, *Navigable waters, Admiralty, Gravels, Shallow water, Navigable rivers, Obstruction to flow, Streams, Sands, Silts, Judicial decisions, Legal aspects, Damages.
Identifiers: *Barges, Obstruction to navigation.

Plaintiff barge owner brought suit in admiralty against defendant sand and gravel company to recover for damages caused when a barge struck a shoal near a point on a river on which defendant maintained a gravel washing plant. Plaintiff established that this shoal was formed by sand and silt which was deposited into the river by defendant's plant and that defendant was well aware of this shoaling process, having received notification of such by the U S Engineers. With this in mind, the court ruled that, since any unreasonable or unauthorized obstruction of a navigable stream is unlawful and constitutes a nuisance, this shoaling was such a nuisance, and plaintiff, who sustained injury to his barge as a proximate result of this obstruction, was entitled to recover damages which he incurred. (Logan-Fla)
W69-07303

BRYANT V CHICAGO MILL AND LUMBER CO (SUIT TO QUIET TITLE TO ACCRETED PROPERTY).

120 F Supp 463-478 (E D Ark 1954).

Descriptors: *Arkansas, *Mississippi River, *Streams, *Accretion (Legal aspects), Boundaries (Property), Bank erosion, Riparian lands, Riparian rights, Proprietary powers, Prescriptive rights, Damages, Remedies, Judicial decisions, Legal aspects, Navigable rivers, Navigable waters.

Plaintiffs brought suit to quiet title to accreted lands, claiming title thereto under a tax deed. The defendants asserted title to the land under various recorded conveyances and by virtue of tax payments made by themselves and their predecessors in title. The court determined that the common predecessor in title of both parties owned the lands in question on both sides of the stream and had sold the property on each side to separate persons. Each conveyance carried with it the accretions on the respective stream bank. Subsequent to the severance of the parcels from their respective accretions, a tax delinquency precipitated a tax sale of the mainland tract and its accretions. This property was purchased by plaintiffs at the sale. The court held that the plaintiffs were seized only of the mainland property and its accretions, finding that the severance of the parcels extinguished any rights the mainland tract owner might assert against accretions located to the east of the stream. (Katz-Fla)
W69-07304

THE DEVELOPMENT OF INTERNATIONAL WATER RESOURCES: THE 'DRAINAGE BASIN APPROACH',
C. B. Bourne.
The Canadian Bar Review, Vol 47, No 1, pp 62-87, March 1969. 26 p, 80 ref.

Descriptors: *Watersheds (Basins), *International law, *Water resources development, *River basins, Water utilization, Water policy, Planning, Basins, Drainage, Watersheds (Divides), Drainage effects, Watercourses (Legal), Water conservation, Water demand, Water resources, Diversion, Water law, Water allocation (Policy), Governments, Watershed management, Withdrawal, United Nations, Political aspects, International waters.

As the interdependence of co-basin states became clearer, it was recognized that international law required the development of the basin as a unit. Most authorities on international law acknowledge that unified development is desirable but deny that it is required by international law. Those who support the development of a drainage basin as a unit are influenced by the physical and economic unity of the basin. But the ability of modern technology to effect trans-basin diversions of waters has reduced the physical unity of many basins, and the development of efficient overland transportation has reduced their economic unity. Since the waters of a river may now serve a much larger population than that of its drainage basin, an approach which takes into account the most beneficial use of the water, whether inside or outside of its drainage basin, would make possible the most rational use of the waters. (Gabrielson-Fla)
W69-07305

PRIVATE LANDS AND WATERS, PUBLIC USE.
Minn Stat, secs 87.01 to 87.04 (1964).

Descriptors: *Minnesota, *Public health, *Public benefits, *Recreation facilities, Legislation, Recreation, Boating, Camping, Ice skating, Skiing, Water skiing, Fishing, Swimming, Water sports, Hunting, Land use, Parks, Recreation demand, Social aspects, Access routes, Roads, Waterway, Damages, Public rights.
Identifiers: Trespass.

State policy calls for the encouragement of the use of privately-owned lands and waters for public recreational facilities. Outdoor recreational use includes hunting, fishing, boating, swimming, skiing and other pursuits for the purpose of outdoor recreation. A free recreational area is a privately-owned area which the owner has made available to the public for recreational uses without compensation. The owner can make his land available by either executing a declaration stating his desire to do so, filed with the office of the register of deeds, or by posting notice on the land itself. No dedication of any land for recreational use shall take place except at the instance of the owner. No liability for damages to person or property occurring on a free recreational area shall lie against the owner except as could be maintained by a tresspasser. (Shevin-Fla)
W69-07306

BANKS V TOWN OF BURNSVILLE (SUIT TO ENJOIN CITY FROM EMPTYING SEWAGE INTO STREAM).
For primary bibliographic entry see Field 05G.
W69-07307

PARMELE V EATON (SUIT TO DETERMINE NAVIGABILITY OF WATER COVERING PROPERTY SUBJECT OF PURCHASE).

240 NC 539, 83 SE 2d 93-99 (1954).

Descriptors: *North Carolina, *Coastal marshes, *Nonnavigable waters, *Beds, Swamps, Tidal marshes, Land reclamation, Shallow water, Guts, Tidal waters, Navigation, Boats, Commercial fishing, Legal aspects, Judicial decisions, Watercourses (Legal), High water mark, Navigable waters, Real property.
Identifiers: Marketable title, Contract of sale.

Plaintiff vendor sued defendant vendee for specific performance of a contract to sell certain real property. Plaintiff had tendered a deed and defendant had refused to accept it, alleging that title was unmarketable in that the land was covered by navigable waters and thus not subject to grant by the state or sale by the State Board of Education (plaintiff's predecessor in title). The appellate court, in affirming the trial court, ruled for plaintiff. The court felt that the evidence sustained the finding that the water covering this 2,000 acre tract of marsh land was not navigable. Ignoring the ebb and flow of the tide as criterion for determining navigability, the court felt the more practical test to be whether, in its ordinary state, a body of water has capacity and suitability for the usual purpose of navigation by vessels or boats such as employed in the ordinary course of water commerce, trade, and travel. The rule accepted by the court was that all watercourses are regarded as navigable in law which are navigable in fact. (Logan-Fla)
W69-07308

POTEETE V CITY OF WATER VALLEY (SUIT FOR DAMAGES RESULTING FROM DIVERSION OF SURFACE WATER).

42 So 2d 112-116 (Miss 1949).

Descriptors: *Mississippi, *Road construction, *Surface drainage, *Diversion, Surface runoff, Surface waters, Ditches, Drainage, Embankments, Levees, Cities, Local governments, Alteration of flow, Judicial decisions, Legal aspects, Relative rights.

Plaintiff landowners brought suit to recover for damages resulting from work done on an adjacent street. Plaintiffs contended this construction diverted the surface water from the street onto their residence lot. The trial court instructed the jury that it was plaintiffs' duty to do all in their power to mitigate damages, and, thus, they should recover no damages for those injuries which could have been prevented by ditching or levying. On appeal, the court declared this instruction to be invalid on two grounds: (1) the plaintiffs (abutting owners) had no legal right to go into the city's street and reopen the ditch or build a levee or embankment without defendant's consent; (2) defendant offered no evidence showing that plaintiffs could have avoided the damage by doing such work on his own property. Therefore, the case was reversed and remanded to the trial court. (Logan-Fla)
W69-07309

HUERTH V TOWN OF PRAIRIE DU SAC (ROAD CONSTRUCTION OBSTRUCTING SURFACE WATER FLOW).
252 Wis 102, 31 NW 2d 187-189 (1948).

Descriptors: *Wisconsin, *Surface drainage, *Road construction, *Natural flow, Roads, Culverts, Outlets, Drainage systems, Rivers, Hay, Crops, Floodwater, Overflow, Ditches, Conduits, Drainage engineering, Obstruction to flow, Surface runoff, Surface waters, Percolating water, Marshes, Local governments, Judicial decisions, Legal aspects.
Identifiers: *Residual flood waters, Seasonal floods.

Plaintiff landowner brought suit against defendant town for damages resulting from town's failure to provide adequate drainage for surface and percolating waters in the construction of two roads intersecting near the corner of plaintiff's land. Plaintiff contended that this intersection forms a dyke which blocks the natural drainage of surface waters from his land in violation of statute. The issue was whether the flow obstructed was in fact a natural flow of drainage water. The court held that even though plaintiff had collected the surface and percolating waters into a drainage ditch, this ditch merely accelerated the movement of surface water in the direction of natural drainage. Obstruction of this ditch was therefore an illegal obstruction. The court further held that while a town does not have to provide for drainage through the path of seasonal flood waters, the statute does require them to provide for adequate drainage of residual flood waters in that these are considered to be surface waters. (Logan-Fla)
W69-07310

MACNEIL V CHICAGO PARK DISTRICTS (SUIT TO ENJOIN COLLECTION OF HARBOR FEES BY MUNICIPALITY).

401 Ill 556, 82 NE 2d 452-456 (1948).

Descriptors: *Illinois, *Harbors, *Navigable waters, *Local governments, Lake Michigan, Submerged Lands Act, Lake shores, Lagoons, Marinas, Beds, Boats, Ownership of beds, Parks, Legislation, State governments, Federal government, Judicial decisions, Legal aspects.
Identifiers: *Harbor fees, Delegation doctrine.

Plaintiff boat owner brought suit to enjoin the defendant Chicago Park District from collecting harbor fees for use of harbor facilities (docking, mooring, etc) on the grounds that harbors are public, navigable waters and, therefore, usable by members of the public free of charge. The court noted two primary issues: (1) whether the fee prescribed by the ordinance is an unconstitutional exercise of municipal authority over navigable waters; and (2) whether the state delegated such power to impose a fee to the Park District. As to the first issue, the court held this was neither an unconstitutional exercise of municipal authority over navigable waters nor an interference with interstate commerce. As to the second, the court found the Illinois statutes provided that submerged lands should be held for the purpose of constructing and maintaining lagoons and harbors for boats, and the establishing and maintaining of regulations for use thereof by the public. The court held this empowered the defendant to establish fees for the use of such special facilities. The court thus affirmed the dismissal of the complaint. (Logan-Fla)
W69-07311

SLAGLE V CITY OF EAST LIVERPOOL (SUIT FOR WASHOUT DAMAGES AND POLLUTION ABATEMENT).

86 NE 2d 37-39 (Ohio Ct App 1948).

Descriptors: *Ohio, *Washouts, *Dredging, *Pollution abatement, Water pollution, Public health, Stagnant water, Odor, Water pollution effects, Channel improvement, Natural streams, Running waters, Watercourses (Legal), Sewage, Obstruction to flow, Culverts, Pipes, Judicial decisions, Legal aspects.

Plaintiff landowners brought suit against defendant city to recover for damages resulting from defendant's dredging and deepening of a watercourse on plaintiffs' property and to abate a nuisance created by rubbish and debris being thrown into this natural watercourse, obstructing the flow and causing the water to become stagnant. It appeared from the evidence that defendant had gone ahead with the dredging of this open, natural watercourse without permission of plaintiffs and that this resulted in a $200.00 loss of land to plaintiffs. In regard to the alleged nuisance, the evidence showed heavy accumulation of waste material in the watercourse; the city was admittedly aware of this condition. The court affirmed the trial court's verdict for the plaintiffs. Concerning the nuisance, however, the court ruled that the trial court had the power to order abatement but not the power to prescribe the manner in which it was to be abated. (Logan-Fla)
W69-07312

UNITED STATES V MARTIN (TITLE TO LAND FILL).
177 F 2d 733-734 (D C Cir 1949).

Descriptors: *District of Columbia, *Riparian rights, *Landfills, *Boundaries (Property), Navigation, Relative rights, Ownership of beds, Riparian land, Accretion (Legal aspects), Federal government, Legislation, Rivers and Harbors Act, Bulkhead line, Piers, Docks, High water mark, Legal aspects, Judicial decisions.

The United States brought suit against certain landowners to establish its title to partially submerged land along the eastern branch of the Potomac River. Defendants are riparian owners who, by natural accretion and much artificial fill, have extended their land into the river beyond the original high water mark established in 1794. Since then, the government has established a bulkhead line some 300 feet beyond the high water mark. Some lots have now been filled up to the bulkhead line, and one wharf has been extended beyond it. The case turned upon ownership of land situated beyond the old high water mark. The court held that an owner of riparian land has the qualified right to make fills and to build wharves in the river, but the exercise of such right does not affect the power of the United States with regard to navigation. That is, the fill and wharf involved could be taken at any time without compensation in the interests of navigation, provided the taking was not arbitrary. (Logan-Fla)
W69-07313

STATE OF WISCONSIN V FEDERAL POWER COMMISSION (NAVIGABLE RIVERS).
214 F 2d 334-338 (7th Cir 1954).

Descriptors: *Wisconsin, *Navigable rivers, *Federal power act, *Federal-state water rights conflicts, Federal government, Navigable waters, Running waters, Streams, Lumbering, Supercritical flow, Administrative agencies, Interstate rivers, Mississippi River, Surface waters, Judicial decisions, Legal aspects.
Identifiers: Saw-log test.

The Federal Power Commission, in granting a project license to a power and light company, had ruled that a certain river was navigable. The Public Service Commission of Wisconsin brought suit to review this order contending that this river was not navigable in that no logs had been transported thereon since 1924. The court first took notice that prior to 1924 this river had been used extensively to transport logs from one state to another. The court held that under both state law (saw-log test of navigability) and federal law (streams suitable for use in the transportation of persons or property in interstate commerce) the east fork of the Chippewa River was navigable and subject to commission control. The fact that the river had not been used for the transportation of logs since 1924 was of no consequence. (Logan-Fla)
W69-07314

NAMEKAGON HYDRO COMPANY V FEDERAL POWER COMM'N (APPLICATION FOR LICENSE UNDER THE FEDERAL POWER ACT).

216 F 2d 509-513 (7th Cir 1954).

Descriptors: *Wisconsin, *Hydroelectric project licensing, *Federal Power Act, *Recreation, Boating, Fishing, Lakes, Rivers, Aesthetics, Reservoirs, Dams, Scenery, Tourism, Wild rivers, Conservation, Hydroelectric plants, Electric power, Legal aspects, Judicial decisions, Relative rights, Administrative agencies.
Identifiers: Substantial evidence rule, Findings of fact, Right to hearing.

This proceeding provided a review of an order by the Federal Power Commission denying petitioner's application for a license to construct a dam and hydroelecric project on the Namekagon River. In its decision, the court first took note that under the Federal Power Act it is solely within the commission's discretion as to whether a license should be granted. Of course, the commission's findings must have a rational basis in fact and be supported by substantial evidence. The court upheld the commission's denial, agreeing with the commission that the unique recreational features of the river (22 miles of free flowing water for fishing, canoeing, sightseeing, etc) were of greater public benefit than use of the river for water-power development. The evidence presented by petitioner tended to show that the dam, if constructed, would create a flowage suitable for both fishing and boating. Such conditions would be comparable to facilities already available in 85 other lakes within a 10 mile radius of the dam site. Therefore, the gains to be derived from the proposed construction were not sufficient to compensate for the resultant loss of this natural river as a unique recreational and tourist attraction. (Logan-Fla)
W69-07316

UNITED STATES V ROSS (CRIMINAL PROSECUTION BASED UPON NAVIGABILITY OF WATER).

74 F Supp 6-9 (E D Mo 1947).

Descriptors: *Missouri, *Borrow pits, *Navigable waters, *Federal jurisdiction, Drainage districts, Levees, Federal government, Hunting, Boats, Nonnavigable waters, High water mark, Legislation, Docks, Rivers, Legal aspects, Judicial decisions, State jurisdiction, Safety, Hazards.
Identifiers: Penalties (Criminal).

Defendant was charged in a criminal information with operating a motor boat in a reckless and negligent manner endangering the lives of others. The main issue was whether the act took place on navigable waters so as to allow the federal government to prosecute the suit. Citing appropriate authority, the court ruled that navigability depends on whether the waters are navigable in fact. Waters are navigable in fact when they are used, or are susceptible of being used in their ordinary condition, as highways for commerce on which trade and travel are or may be conducted. The mere ability to cause a small boat to float upon a watercourse at high water or to push or pole a small boat through that water does not render such water body navigable. Therefore, the court held the 'borrow pit' (area from which soil had been taken to build a levee) wherein the defendant's acts had taken place was a nonnavigable body of water and, therefore, that the federal government had no jurisdiction over the offense in question. (Logan-Fla)
W69-07317

GEIGER V CITY OF NEW YORK (DAMAGE FROM STORM SEWER INSTALLATION).

141 NYS 2d 667-670 (N Y Sup Ct 1955).

Descriptors: *New York, *Storm drains, *Drainage effects, *Road construction, Grading, Drainage engineering, Sewers, Surface runoff, Surface drainage, Surface waters, Paving, Graded, Natural flow, Cities, Local governments, Legal aspects, Judicial decisions, Overflow, Damages.

Plaintiff property owners filed suit against the city to enjoin maintenance of an alleged nuisance to compel its abatement, and to recover damages. The

suit was precipitated by installation of a storm sewer which required the street to be raised to a level above that of adjacent sidewalks. This caused water to run off the street onto plaintiffs' property. The court, noting that the present grade was still below the legal grade, reiterated the rule that when there is a change of grade, in the absence of negligence, the resulting damages to real property abutting the newly graded street are damnum absque injuria in the absence of legislation authorizing recovery for such damages. Finding no evidence of negligence, the court dismissed the suit. Furthermore, the court held that the city was under no duty to furnish drainage systems for water naturally collected in the street and that a city cannot be held liable for damage occasioned by the natural flow of surface water. (Logan-Fla)
W69-07318

HATHORN V BOARD OF COMMISSIONERS (LEVEE MAINTENANCE).
218 So 2d 335-341 (3rd C C A La 1969).

Descriptors: *Louisiana, *Levees, *Flood protection, *Riparian land, Navigable rivers, Streams, Bayous, Appropriation, Flood control, Drainage systems, Public benefits, Overflow, Cattle, Legal aspects, Judicial decisions, Riparian rights, Administrative agencies.
Identifiers: *Fences, *Levee servitude, Cattle guards, Injunctions (Prohibitory).

A levee board adopted a resolution requiring landowners to remove fences along the levee crown unless cattle gates were installed. The landowners sued to enjoin the levee board from enforcing the resolution. The court noted that the public enjoyed a servitude for the making and repairing of levees on land adjacent to navigable rivers and streams. Riparian lands are regarded as burdened with this servitude at the time they are severed from the public domain. The landowners are regarded as holding subject to this servitude, and due process does not protect riparian owners from appropriation or damage to their lands for levee purposes without prior judicial proceedings. The actions of a public agency in locating, building, and maintaining a levee are not subject to judicial review except in the case of palpable abuse. The court cannot substitute its own judgment for that of the state's levee board which is responsible for protecting the public from floods. The public's levee servitude is limited only by the reasonableness of its use. The court held that it was not an unreasonable determination by the board that the fences created an obstacle to the performance of its duties and that the levee board has a right to require landowners to remove their fences as obstacles to the maintenance of the levee. (Shevin-Fla)
W69-07320

WOODWARD IRON CO V EARLEY (SUIT AGAINST MINE OPERATOR FOR LOSS OF WELL WATER).

25 So 2d 267-270 (Ala 1946).

Descriptors: *Alabama, *Mining engineering, *Water wells, *Water loss, Wells, Deep wells, Underground, Percolating water, Subsurface waters, Percolation, Mining, Coal mines, Shafts (Excavation), Damages, Leakage, Legal aspects, Judicial decisions, Drainage.
Identifiers: 'Squeeze', Superjacent owner.

Plaintiff superjacent landowner brought suit against defendant mining company alleging that negligence in the operation of a mine caused plaintiff's well to go dry. Plaintiff's testimony, as well as that of expert witnesses, revealed that defendant's mining techniques, which included leaving an insufficient number of pillars within the mine, led to a 'squeeze' which caused cracks to form towards the surface, draining water from adjacent wells. The court stated that a mine operator is not liable for incidental damages (such as loss of a well by the superjacent owner) necessarily occasioned by the ordinary, careful operation of the mine in a manner not injurious to the surface. But, the court added, the issue of failure to exercise due care is a jury question and was therefore properly submitted to the triers of fact for determination. Furthermore, the evidence was sufficient to support a finding that defendant had in fact negligently operated the mine. But the court considered the lower court's award of $1200 damages as excessive and required remittitur. (Logan-Fla)
W69-07321

CITY OF WEST FRANKFORT V FULLOP (SUIT TO ENJOIN DRILLING AND OPERATION OF GAS AND OIL WELLS).
For primary bibliographic entry see Field 05G.
W69-07322

STATE V PINDER (ACTION TO REMOVE AN OBSTRUCTION FROM A DRAINAGE DITCH).

41 So 2d 479-485 (La Ct App 1949).

Descriptors: *Louisiana, *Surface drainage, *Relative rights, *Obstruction to flow, Surface waters, Surface runoff, Rainwater, Judicial decisions, Civil law, Natural flow, Drainage systems, Drainage water, Ditches, Drains, Controlled drainage, Drainage effects, Prescriptive rights, Riddance (Legal aspects), State governments, Local governments, Drainage engineering, Remedies.
Identifiers: Injunctions (Prohibitory).

Plaintiff brought this suit to have defendant enjoined from obstructing a drainage ditch. Plaintiff and defendant owned abutting lots; defendant's land was lower than plaintiff's. Over twenty years prior to this action, the city had constructed a drainage ditch across plaintiff's land and alongside defendant's property. Prior to the time when defendant became owner of the adjacent plot, plaintiff laid a pipe in the ditch crossing his land and covered the ditch over. The pipe ended eighteen inches from defendant's property. Plaintiff alleged that defendant had filled up the ditch on the side of his land and had placed an obstruction near the end of the drainage pipe which had caused water to back up on plaintiff's land. The court held that the defendant had wrongfully filled in the ditch. Since the ditch had been used for over ten years, it had become a continuous apparent servitude acquired by prescription. Defendant also acted wrongfully in obstructing the flow of water from the drainage pipe. The landowner whose waters flow naturally over another's land, may concentrate and increase the flow artificially provided he has drained only the water which normally flows across the other's land. Defendant could not impede the drainage onto his land without a showing that the drain added water to the natural quantity of water flowing across his land. (Kelly-Fla)
W69-07323

JONES V WALKER (ACTION TO ENJOIN MAINTENANCE OF AN EMBANKMENT).

44 So 2d 466-467 (Miss 1950).

Descriptors: *Mississippi, *Surface drainage, *Natural flow, *Alteration of flow, Storm runoff, Surface runoff, Relative rights, Judicial decisions, Surface waters, Rainwater, Rainfall-runoff relationships, Drainage engineering, Natural streams, Embankments, Flood damage, Drainage effects, Drainage systems, Remedies, Riddance (Legal aspects), Repulsion (Legal aspects), Flow augmentation, Diversion structures.
Identifiers: Injunctions (Prohibitory).

Plaintiff brought this suit to have defendant enjoined from maintaining a small embankment which caused water to flow into a natural stream. Plaintiff and defendant owned lands on opposite sides of a natural creek. In times of heavy rain, a natural hollow on defendant's land caused surface water to collect and overflow onto his cultivated fields. Defendant constructed an embankment on his land which caused waters in the hollow to flow into the creek instead of onto his land. Plaintiff contended that the embankment caused an excessive amount of water to flow into the creek so as to overflow plaintiff's land. The court held that since the embankment had the effect of causing the surface water to flow into the creek, a natural watercourse, and since it was not erected for the purpose of diverting a natural watercourse, it was a lawful protection of defendant's lands and plaintiff was not entitled to injunctive relief. (Kelly-Fla)
W69-07324

METROPOLITAN DISTRICT ACT.

Mich Comp Laws Ann secs 119.1, 119.1a, 119.2 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Public utility districts, *Water supply, *Sewage disposal, Drainage, Cities, Legislation, Parks, Public utilities, Contracts, Transportation, Operations, Legal aspects.
Identifiers: *Incorporation, *Elector approval, *City boundaries.

Any two or more cities, villages or townships may incorporate into a metropolitan district to acquire and operate parks or public utilities for supplying sewage disposal, drainage, water or transportation within or without their limits. Any such district may sell or purchase within or without its limits any rights or facilities listed above, and may succeed to such rights and facilities of any municipality. No municipality shall surrender rights, obligations, or property without the approval of a majority of its electors. (Harris-Fla)
W69-07325

TOWNSHIPS: WHARFS, PIERS AND DOCKS.

Mich Comp Laws Ann secs 41.481, 41.482 (1967).

Descriptors: *Michigan, *Operation and maintenance, *Piers, *Docks, Legislation, Contracts, Water law, Public rights, Leases, Navigable waters, Legal aspects, Cities, Administrative agencies, Public benefits, Construction.
Identifiers: *Townships, *Elector approval.

Any township situated upon any navigable waters may, through its township board, acquire, construct, and maintain wharfs, piers, docks and landing places for the public benefit. Authorization shall be by an affirmative vote of 3/5 of the qualified electors voting at a general or special election. The township board is vested with authority usually exercised by the township's highway commissioner, and the general highway law is extended to include such landing places. (Harris-Fla)
W69-07326

SEWERS AND DRAINS.

Me Rev Stat Ann tit 30, secs 4351--4359 (1965), as amended, (Supp 1968).

Descriptors: *Maine, *Legislation, *Sewers, *Drains, *Cities, Conduits, Drainage systems, Pipes, Sewage, Storm drains, Subsurface drains, Cesspools, Septic tanks, Drainage programs, Outlets, Condemnation, Local governments, Domestic wastes, Legal aspects.

Towns may construct public drains and sewers when such are deemed necessary for the public good. Public drains shall be maintained so as to provide suitable flow. If drains are not kept in repair, any person damaged by reason of such disrepair shall have an action against the town. Before land is taken for drains, notice shall be given and damages assessed and paid. The municipal officers may establish and collect service charges for the use of the system. Whoever wilfully or carelessly injures a public drain shall be liable for double

damages. If a drain is to cross a railroad, unless a place for crossing can be determined by the town and railroad company, the public utilities commission shall choose an appropriate place. No one shall dig up a highway to lay a drain without consent of the town. Malfunctioning domestic sewage disposal units are to be considered a nuisance. An order to remedy a malfunctioning domestic unit may be sued upon by the landowner or occupant, and he shall have 10 days to remedy the defect. If the nuisance is not abated in 10 days, the municipal officers may enter upon the premises and remedy the malfunction. Any expenses of entry shall be recovered from the owner or by means of a tax assessed upon and collected in the next tax warrant. (Helwig-Fla)
W69-07327

JOHNSON V AGERBECK (SURFACE WATERS).
77 NW 2d 539-551 (Minn 1956).

Descriptors: *Minnesota, *Surface waters, *Reasonable use, Surface drainage, Surface runoff, Culverts, Ditches, Furrows, Drainage systems, Land use, Land forming, Agriculture, Judicial decisions, Legal aspects.
Identifiers: Injunctions.

The Minnesota Supreme Court reversed injunctive relief awarded by the lower court to plaintiff landowners in his action to compel defendants to fill up a ditch through which surface waters flowed onto plaintiffs' land. The court held that the evidence, particularly expert testimony on behalf of the defendants by engineers regarding land levels and height, did not support the lower court's finding that defendants had unreasonably caused surface waters to flow in increased volume onto plaintiffs' land. After defining surface waters, the court enunciated Minnesota's rule regarding reasonable use thereof: In making reasonable use of land for a legitimate purpose, a landowner may drain his land of surface waters and cast them upon adjacent land provided that he heeds existing circumstances, that there is a reasonable necessity for such drainage, that he takes reasonable care to avoid unnecessary injury to adjacent land, that utility or benefit accruing to his land reasonably outweighs harm resulting to burdened land, and that, where practicable, it is accomplished by reasonably improving the normal system of drainage according to its reasonable care and capacity. (Carruthers-Fla)
W69-07328

DELAWARE RIVER BASIN WATER COMM'N COMPACT.

N Y Unconsolidated Laws secs 1581, 1582, 1583, 1584 (McKinney Supp Dec 1968).

Descriptors: *New York, *Delaware River, *Interstate compacts, *Water resources development, New Jersey, Pennsylvania, Delaware River Basin Comm'n, Streams, Surface waters, State governments, Dams, Reservoirs, Impounded waters, Riparian rights, Riparian lands, Eminent domain, Condemnation, Legislation, Water conservation, Water demand, Water supply, Water distribution (Applied), Public benefits, Legal aspects, Competing uses.

The states of New Jersey, New York, and Pennsylvania, having a common interest in the waters of the Delaware River Basin, have entered into a compact. This compact is intended to facilitate the development, utilization, control and conservation of the water resources of the Delaware River. The states have agreed to create a joint advisory board known as the 'Delaware River Basin Water Commission'. The function of this commission is to formulate and recommend integrated programs for the development of the water resources of the Delaware River Basin. The Commission is to study the feasibility of the future construction of an integrated water supply system which would supply the water needs of all the signatory states. The Commission is responsible for providing an adequate minimum flow in the Delaware River and is required to provide an adequate supply of water for such purposes as navigation, flood control, and production of hydroelectric power. The Commission is empowered to effectuate the foregoing purposes through the acquisition of dams, reservoirs, and related facilities. The Delaware Basin constitutes all that land from which surface water drains naturally into the Delaware River. (Katz-Fla)
W69-07329

SEABOARD AIR LINE RR V SARASOTA-FRUITVILLE DRAINAGE DIST (LIABILITY OF DRAINAGE DIST FOR ITS TORTS).
255 F 2d 622-626 (5th Cir 1958).

Descriptors: *United States, *Drainage districts, *Railroads, *Contracts, Ditches, Culverts, Installation, Right of way, Drains, Administrative agencies, Taxes, Maintenance, Permits, Legal aspects, State governments, Florida.
Identifiers: *Public policy, Torts.

A railroad brought an action against a drainage district for damages from a train derailment allegedly caused by the lowering of ditches adjacent to the district's undertrack culverts causing the railroad's roadbed to give way. Plaintiff alleged that the defendant was liable under an agreement whereby defendant agreed to indemnify the railroad for damages growing out of the presence of culverts which plaintiff had permitted defendant to install beneath its tracks. The court stated that the sovereign cannot be sued without its consent. Furthermore, under Florida law, a statutory drainage district is not liable for its torts as the district can only levy taxes for the improvement and maintenance of the district. The court declared that since the district could not be liable by law in tort for its negligence, it should not be allowed to accept such liability as consideration for the acquisition of a valuable right. The court concluded that where a taxing unit such as defendant district obligates itself to use tax money in a way not authorized, this amounts to an illegal commitment to expend tax funds and is against public policy. Therefore, the indemnity agreement was void and plaintiff could not enforce it to recover damages. (Reed-Fla)
W69-07330

LOPEZ V SMITH (BOUNDARY DISPUTE).

109 So 2d 176-180 (Fla DCA 1959).

Descriptors: *Florida, *Boundary disputes, *Navigable rivers, Nonnavigable waters, Patents, Meanders, Tributaries, Tides, High water mark, Tidal waters, Water levels, Judicial decisions, Water law, Water rights, Streams, Legal aspects.
Identifiers: Suit to quiet title.

The Second District Court of Appeal of Florida reversed a chancellor's decree which dismissed appellants' complaint in an action to quiet title to certain islands bordering on a river and its branches. On appeal the court delineated the main issue between the respective parties as involving the location of the boundary lines of certain government lots. This issue, in turn, was dependent on two others: (1) whether the meander lines or the ordinary high water mark delineate the boundaries, and (2) whether all of the branches of the Little Manatee River are navigable. The court noted the general rule that a meander line is not a boundary and that generally the ordinary high water mark of lands located upon navigable waters delineates the boundary. The court also observed that the factor which determines navigability is the water's capacity for navigation, not its usage for that purpose and that navigable waters do not extend to all waters affected by tides which are not in fact capable of navigation for useful public purposes. Since the pleadings did not incontrovertibly establish navigability, the complaint was sufficient to withstand the motion to dismiss. (Carruthers-Fla)
W69-07331

TYSON V STATE OF IOWA (OWNERSHIP OF ACCRETED LAND).

283 F 2d 802-811 (8th Cir 1960).

Descriptors: *Iowa, *Missouri River, *Nebraska, *Accretion (Legal aspects), Federal government, Riparian land, Channel improvement, Condemnation, Islands, State jurisdiction, River beds, Beds under water, Boundary disputes, Banks, Ownership of beds, Boundaries (Property), Riparian rights.

In an action by the United States to condemn land needed to stabilize the channel of the Missouri River, there were conflicting claims as to ownership of the land. The court found Iowa law applicable since the entire river bed was located in Iowa. The court rejected the first defendant's claim since, under Iowa law, when a river moves over the owner's land, gradually destroying it, title to the shifting bed passes from the owner to the state. Islands subsequently forming on this bed likewise belong to the state. The second claimant established ownership of the lands in Nebraska on the Nebraska bank of the river and claimed all the land in controversy as accretions to his land. Although both Iowa and Nebraska recognize the right to acquire land by accretion, under Iowa law, the riparian owner does not own the river bed to the thread of the stream. The court found that the land in controversy had formed as islands growing up from the river bed; thus, title was vested in the state of Iowa. The state of Iowa was determined to be the owner of all the land in controversy. (Kahle-Fla)
W69-07332

ILLINOIS CENTRAL RAILROAD CO V GEORGE (DIVERSION OF SURFACE WATERS).
130 So 2d 260-262 (Miss 1961).

Descriptors: *Mississippi, *Diversion structures, *Railroads, Right of way, Relative rights, Flumes, Judicial decisions, Alteration of flow, Damages, Conveyance structures, Ditches, Drains, Drainage, Surface waters, Surface drainage, Legal aspects, Flooding.
Identifiers: Perpetual injunction.

The Supreme Court of Mississippi affirmed the chancery court's award of damages but reversed the perpetual injunction rendered against defendant railroad in plaintiff landowner's action for damages and injunctive relief for defendant's diversion of waters onto plaintiff's land. The evidence was found to support plaintiff's allegation that the railroads widening of drainage ditches along its right of way caused drainage of about three times as much surface water upon plaintiff's land as had theretofore drained upon plaintiff's land. This necessitated plaintiff's construction of an extra flume to take care of the excess water. But the court considered the perpetual injunction enjoining the railroad from permitting any surface water to flow from a certain point along its right of way to another point thereon to be too vague to enable the railroad to determine from the face of the decree just what it is enjoined from doing or not doing. The court remanded the case in order to allow the chancery court to grant more specific injunctive relief. (Carruthers-Fla)
W69-07333

CITY COUNCIL OF AUGUSTA V THORP (INTERFERENCE WITH NATURAL DRAINAGE).

103 Ga App 431, 119 SE 2d 595-598 (1961).

Descriptors: *Georgia, *Cities, Drainage systems, Road design, Road construction, City planning, Land development, Judicial decisions, Surface

waters, Damages, Alteration of flow, Diversion, Diversion structures, Flood damage, Flooding, Legal aspects.
Identifiers: Continuing nuisance.

The court affirmed a judgment for plaintiff rendered by the lower court in an action against the city of Augusta and subdivision developers for flooding and other damage caused by improper construction of streets. The city had been a party to a contract with subdivision developers whereby the city drew plans for street construction which were to be performed by the developers. The streets allegedly were constructed in so negligent a manner as to collect, divert and channel all the surface water onto and across plaintiff's property, causing him damage. The court observed that a general grant of power to grade streets and establish drainage systems does not include the right of a municipality to create a nuisance by causing surface water to be discharged upon a citizen's premises. The court further found that the evidence supported the lower court's finding of negligence and continuing nuisance. (Carruthers-Fla)
W69-07334

MORRIS V STATE (FLOOD DAMAGE CAUSED BY STATE CONSTRUCTION PROJECT).

10 A D 2d 754, 198 NYS 2d 59-62 (1960).

Descriptors: *New York, *Drainage engineering, *Flood damage, *State governments, Culverts, Floods, Contract administration, Cities, Spillways, Flood control, Drainage systems, Distribution systems, Municipal wastes, Surface drainage, Road construction, Legal aspects.
Identifiers: *Nondelegable duties, Independent contractors, Respondent superior, Agency.

Property owners brought an action against the state for flood damage allegedly resulting from the state's negligence in providing defective specifications for a construction project and from the manner of actual construction. During a storm, flood damage was caused by the obstruction of a culvert. Initially, the court rejected plaintiffs' claim that the state was negligent because it was in control of the work. The court stated that where such work is being done by an independent contractor, the presence of state engineers is not for the purpose of exercising control over the manner of construction, but to see that the plans are adhered to by the contractor. The court also found that the work undertaken pursuant to the project was not of an inherently dangerous nature and that the state's duty to use care in performance of the project was not a nondelegable duty. The court further held that the specifications for the project were not defective, but designed according to proper engineering procedure. Since the independent contractor was not a party to the action, the court did not pass on its liability. The state was without liability for the flood damage. (Reed-Fla)
W69-07336

LAWS AND PROGRAMS PERTAINING TO WATER AND RELATED LAND RESOURCES,
Texas Water Development Board, Austin.
Donald B. Yarbrough.
Tex Water Develop Board Rep No 89, Dec 1968. 34 p.

Descriptors: *Water law, *Texas, *Prior appropriation, *Riparian rights, Treaties, Water policy, Water resources development, Water rights, Water transfer, Governments, Civil law, Interstate compacts, Water allocation (Policy), Administration.
Identifiers: *Texas Water Development Board.

The history of Texas water law is reviewed. All State, National, International and legal agencies concerned with water are listed, and the roles of districts, local agencies, and interstate compacts in coordinating water activities in Texas are outlined. Texas recognizes 2 fundamental doctrines of water rights, the Riparian and Appropriation types. All streambeds, lakes, bays, and beds of navigable waters belong to the State. (Knapp-USGS)
W69-07408

VALUES, ETHICS AND POLICY IN RELATION TO RESOURCE DEVELOPMENT AND CONSERVATION: A SELECTED BIBLIOGRAPHY,
Nevada Univ., Reno. Dept. of Philosophy.
Robert Roelofs.
Desert Research Institute, Water Resources Research Center, Preliminary First Edition, 18 pp, Apr 1968. 194 ref.

Descriptors: *Values, *Ethics, *Resource development, *Conservation, *Bibliographies, History, Resources, Ecology, Economics, Education, Natural resources, Environment.
Identifiers: *Public policy, *Environmental problems, Future studies, Science and technology, Philosophy.

There is a growing concern over environmental deterioration and adverse biological and psychological effects it may have on individuals and, eventually, on our social institutions and society as a whole. This bibliography is a preliminary attempt to organize books and articles dealing with problems concerning natural resources and natural environment with emphasis on social and humanistic concerns relating to the environment. This preliminary first edition contains 194 entries which are numered, classified, and cross-indexed under eleven topics. The topics and relative percentages of entries relating to each, are as follows: History, 5 percent; Resources, 10 percent; Conservation, 8 percent; Ecology, 5 percent; Economics, 7 percent; Public Policy, 19 percent; Future Studies, 6 percent; Science and Technology, 6 percent; Human Values, 23 percent; Philosophy, 6 percent; Education, 5 percent. Items included in the bibliography are chosen on their relevance to one or more of these topics from the viewpoint of social and personal values, and realization potential in light of realities of the environment. The author's stated purpose in compiling the bibliography is to furnish a guide to specialists involved in resource investigations, and concerned with the broader implications of their task; as well as social scientists and others involved in various aspects of environmental problems. (Ketelle-Wisc)
W69-07437

MUNICIPAL WATER PROBLEMS - SOME LEGAL ASPECTS,
Thomas A. Matthews.
Current Municipal Problems, Vol 1, No 1, pp 8-16, August 1959. 8 p.

Descriptors: *Legal aspects, *Municipal water supply, Distribution, Water quality control, Financing, Irrigation, Jurisdiction, *Legislation, Institutional constraints, Public benefits, Public rights, Equitable apportionment, Supply contracts, Water transfer, Riparian rights.
Identifiers: Legislative aspects.

Where the source of water supply is distant from the area to be served, the legislature should grant authority to acquire and make use of a source of supply. Municipalities should also have the power to prevent contamination of the source. The legislature must resolve conflicts of interests between various municipalities and between agricultural and urban interests. There is a growing need for legislation to control and regulate the use of water from underground sources in order to insure proper distribution of the limited supply among those consumers needing it. Potential legal problems could arise from 'cloud seeding', weather modification, and controlled subterranean nuclear explosions to affect underground supply. Certain recommendations are made: (1) adequate means of financing, by revenue bonds or otherwise, must be made available, (2) statutes preventing pollution of water supplies, and (3) the legislature should allocate the right to use both underground and surface sources between municipal and agricultural uses, and between urban communities whose needs may conflict. (Gargola-Chicago)
W69-07452

THE ADMINISTRATION OF OFFSHORE MINERAL LEASING STATUTES IN THE GULF OF MEXICO (LOUISIANA AND TEXAS),
For primary bibliographic entry see Field 05G.
W69-07577

NATIONAL WATER COMM'N.

Hearings on S 3107 Before the Senate Comm on Interior and insular Affairs, 89th Cong, 2nd Sess (1966).

Descriptors: *United States, *Water resources development, *Planning, *Water requirements, Legislation, Water allocation (Policy), Social aspects, Water utilization, Natural resources, Conservation, Economics, Water supply, Pollution, Water policy, Inter-basin transfers, Desalination, Water purification, Water reuse, Institutions, Water resources planning, Future planning (Projected), Legal aspects.
Identifiers: *National Water Comm'n, Senate Hearings.

A hearing was held before the Senate Committee on Interior and Insular Affaris on S 3107. This bill would create a national water commission which would: (1) review present and anticipated national water resource problems, project water requirements and identify alternative ways to meet these requirements--considering conservation, more efficient use of existing supplies, increased usability by reduction of pollution, innovations to encourage the highest economic use of water, inter-basin transfers, and technological advances such as desalting, waste water purification and reuse; (2) consider economic and social consequences of water resource development, including the impact of water resource development on regional economic growth, on institutional arrangements and on aesthetic values; and (3) advise on such specific water resource matters as may be referred to it by the President and the Water Resources Council. (Childs-Fla)
W69-07580

THE ATLANTIC STATES MARINE FISHERIES COMM'N.

Conn Gen Stat Ann secs 26-295 to 26-301 (1960).

Descriptors: *Connecticut, *Fisheries, *Fish conservation, *Interstate compacts, Legal aspects, Legislation, Regulation, Fish management, Wildlife conservation, Commercial fishing, Financing, Administrative agencies, State governments.
Identifiers: Atlantic State Marine Fisheries Comm'n.

The governor of Connecticut is empowered to execute a compact on behalf of the state in the Atlantic States Fisheries Commission. The Commission is open to all states on the Atlantic seaboard. The statute further goes on to recognize the compact in Connecticut and establish qualifications and powers of members to the Commission established by the compact. Provision is made for funds for the Commission as well as for accounting for receipts and disbursements by that body. (Johnson-Fla)
W69-07581

COMPACT FOR STATE MEMBERSHIP IN THE ATLANTIC STATES MARINE FISHERIES COMM'N.

Conn Gen Stat Ann sec 26-295 (1960).

Descriptors: *Connecticut, *Fisheries, *Fish conservation, *Interstate compacts, Legal aspects, Legislation, Regulation, Federal government,

Water management (Applied), Fish management, Habitat improvement, Marine fish, Anadromous fish, Water conservation, Fish, Wildlife conservation, Commercial fishing, Financing, Administrative agencies, State governments.
Identifiers: Federal-state relations, Atlantic State Marine Fisheries Comm'n.

The compact's purpose is promotion of better utilization of Atlantic seaboard fisheries by development of a joint program for the promotion, protection, and conservation of such fisheries. The agreement becomes effective when any two or more Atlantic seaboard states join. Each member state will appoint three representatives to the Commission. One each will be selected from the appropriate department of the state's executive and legislative branches and one from the interested public. The duty of the Commission is to promote and bring about conservation of and prevention of depletion and physical waste of the fisheries, marine, shell and anadromous, of the Atlantic seaboard. The Commission may recommend coordination of the police powers of the several states, as well as suggest pertinent legislation. It may consult with appropriate administrative agencies of signatories. The Commission is further permitted to recommend stocking of waters and will be the coordinating agency for joint stocking. In cooperation with state agencies the federal fish and Wildlife Service of the Department of the Interior will act as research agency for the Commission. Annual appropriations in proportion to market value of fisheries products are established. (Johnson-Fla)
W69-07582

THE ATLANTIC STATES MARINE FISHERIES COMM'N (IMPLEMENTATION).

Conn Gen Stat Ann secs 26-296 to 26-301 (1960).

Descriptors: *Connecticut, *Fisheries, *Fish management, *Interstate compacts, Fish conservation, Legal aspects, Legislation, State governments, Administrative agencies, Financing, Commercial fishing, Marine fish, Anadromous fish, Fish management, Fish, Water management (Applied), Interstate commissions.
Identifiers: Atlantic States Marine Fisheries Comm'n.

Adoption of the compact creating the Commission as a joint regulatory agency with such powers as members may jointly confer upon it for the regulation of fishing operations in which members have a common interest is made. Commissioners from Connecticut will be: (1) chairman of the state board of fisheries and game, (2) a legislator and member of the Commission on intergovernmental cooperation of the state, and (3) a citizen with a knowledge and interest in the marine fisheries problem appointed by the governor. Term of office of the first two will correspond with their holding of public office. The latter's term will be three years. Powers in the compact are granted to the Commission. All officers of the state are directed to cooperate in carrying out the purposes of the compact. The Commission on intergovernmental cooperation will include in its budget necessary funds required by the Commission. The Commission will keep appropriate accounts of receipts and expenditures. (Johnson-Fla)
W69-07583

CHARACTERIZATION OF INTERSTATE ARRANGEMENTS: WHEN IS A COMPACT NOT A COMPACT,
David E. Engdahl.
Mich L Rev, Vol 64, No 1, pp 63-104, Nov 1965. 42 p, 212 ref.

Descriptors: *Interstate compacts, *Interstate rivers, *International law, *State governments, Political aspects, Legal aspects, Boundary disputes, Public health, Conservation, Judicial decisions, Federal government, Safety.
Identifiers: *Constitutional law.

Formal interstate arrangements dealing with governmental problems affecting more than one state have become increasingly common in recent years. These 'compacts' generally deal with coordinated programs to promote conservation, health, safety, and similar matters such as interstate canals, bridges, and settlement of boundary water disputes. The question often arises whether such arrangements come within Article I, section 10 of The United States Constitution, which forbids entry by any state into a treaty, alliance, or confederation, and requires congressional consent for any agreement or compact with another state or foreign power. A study in semantics reveals that federal and state courts have erred in assuming all such agreements come within the constitutional provision. Although congressional assent may be sought to secure federal assistance or political gains, it is required by the Constitution only in case of 'dispositive' arrangements such as those apportioning interstate waters--not in the vast majority of 'cooperative' arrangements. The courts should review past decisions in light of the practical need for freedom among the states to cooperate so long as such cooperation does not preempt federal authority. (Harris-Fla)
W69-07584

PASSAIC VALLEY SEWERAGE DISTRICT.
For primary bibliographic entry see Field 05G.
W69-07585

JOHNSON V WILLS (DRAINAGE OVER ADJACENT PROPERTY).
For primary bibliographic entry see Field 04A.
W69-07586

HALL V WANTZ (PUBLIC EASEMENT OF NAVIGATION TO RIPARIAN RIGHTS).

336 Mich 112, 57 NS2d 462-465 (1953).

Descriptors: *Michigan, *Public rights, *Competing uses, Riparian rights, Lakes, Lake shores, Judicial decisions, Navigation, Navigable waters, Public benefits, Relative rights, Riparian land, Recreation, Reasonable use, Fishing, Water law, Easements, Great Lakes, Inland waterways.
Identifiers: *Subaqueous lands, White Lake, Anchorage, Injunctions (Permanent).

Plaintiffs appealed from a lower court ruling dismissing plaintiffs' bill of complaint for a perpetual injunction restraining defendant from mooring his fishing raft along the shore of plaintiffs' properties fronting on Michigan's White Lake. The Supreme Court of Michigan granted a permanent injunction restraining defendant from anchoring his 40 foot floating raft, from which defendant permits persons to fish for a fee, in front of plaintiffs' shoreline. The court reviewed Michigan's laws regarding the rights of the public and riparian owners to use of navigable inland waterways and concluded that while a riparian owner's property rights to subaqueous lands are subject to an easement in the public for general recreation and navigation purposes, nevertheless the right of navigation does not include the right to anchor indefinitely off the riparian owner's premises, particularly when it is attended with consequent impairment of the riparian owner's use and enjoyment of his property rights. (Carruthers-Fla)
W69-07587

ROUND VALLEY RESERVATION SPRUCE RUN RESERVATION.

N J Stat Ann secs 58:20-1 to 58:20-4, 58:21-1 to 58:21-5.

Descriptors: *New Jersey, *Reservoirs, *Water resource development, *Water supply, Legislation, Eminent domain, Conservation, Water resources, Water utilization, Planning, Water policy, Water management (Applied), Construction, Stream flow, Water works, Eminent domain, Flow rates, Administrative agencies, Delaware River, Water distribution (Applied).

The Commissioner of Conservation and Economic Development shall acquire for the state such part of Round Valley as is appropriate for the establishment of a water supply system. The Delaware River or the south branch of the Raritan River shall be the source. No water shall be pumped from the Raritan into a reservoir to be constructed when its flow is below certain specified rates, or from June 15 to September 15 of any year. Whenever the flow is below the specified rates, water shall be released from such other reservoirs as may be constructed on the Raritan to make up the deficiency. Upon completion of the reservoir not less than 830,000 gallons daily shall be released into Prescott Brook and not less than 170,000 gallons daily into the south branch of Rockaway Creek. Acquisition of property shall be by purchase or by eminent domain with the attorney general representing the state. Real property shall be used primarily in connection with a water supply system, but may be used incidentally for recreation or other state uses. The commissioner is ordered to obtain part of the area called Spruce Run for the establishment of a water supply system. Acquisition shall be by purchase or eminent domain. The commissioner may exchange lands acquired in excess of state needs for other lands authorized to be acquired. Real property shall be used primarily for a water supply system, but may be used incidentally for recreation or other state needs. (Kahle-Fla)
W69-07588

WEBB V GIDDENS (RIPARIAN RIGHTS).
82 So 2d 743-745 (Fla 1955).

Descriptors: *Florida, *Riparian rights, *Navigable waters, *Road construction, Recreation, Legal aspects, Judicial decisions, Riparian land, Obstruction to flow, Relative rights, Lakes, Boating, Swimming, Fishing, Access routes, Hunting, Landfills, Culverts.
Identifiers: Right of ingress, Right of egress.

Plaintiff was a riparian owner of lands bordering on an arm of a navigable, landlocked lake. Plaintiff's business was that of renting boats. The state road department removed an existing bridge and built a landfill across the arm of the lake. Plaintiff brought suit to determine the right of defendants to obstruct navigable waters and prevent plaintiff from passing from his land to the larger body of the lake. Defendants claimed that plaintiff's riparian rights only guaranteed him ingress and egress to the waters immediately adjacent to his land, and that the denial of ingress and egress to the main body of the lake was not an infringement upon his riparian proprietorship. The court held that the rights of riparian proprietorship must be determined by the facts and circumstances of each case. The court stated that in the present case the plaintiff's right would be meaningless unless he were allowed access to the main body of the lake. (Shevin-Fla)
W69-07589

ISELIN V C W HUNTER CO (OWNERSHIP OF ACCRETION).

173 F 2d 388-393 (5th Cir 1949).

Descriptors: *Louisiana, *Accretion (Legal aspects), *Land tenure, *Islands, Land forming, Judicial decisions, Legal aspects, Remedies, Real property, Riparian land, Avulsion, Rivers, Boundaries (Property), Adjudication procedure, Water law, Maps.

Appellants sought to establish their title to obtain land which they alleged was in their possession. The land in question, also claimed by appellee, was part of an island in the Mississippi River between Louisiana and Mississippi. Appellee acquired title from the appellants and the land was described within the deed generally by metes and bounds and, more particularly, by reference to a map that

estricted the general descriptions. Appellants claimed that the land identified by the map was smaller in area than that indicated by the metes and bounds description. Appellee's claim was based upon the broader general descriptions. Particularly in issue was whether appellants had divested themselves of the full acreage embraced in all three descriptions. The court held that appellants had a cause of action and were entitled to a plenary trial on the issues involving which descriptions were determinitive. The court indicated that where accretions are entirely to an island, land so formed belongs to the owner of the island. They also noted that what constitutes avulsion is a question of law, while whether avulsion occurred is a question of fact. (Holt-Fla)
W69-07590

MISCELLANEOUS STATUTES (WATERSHED MANAGEMENT).
For primary bibliographic entry see Field 04D.
W69-07591

CROW V JOHNSTON (TITLE TO LAND FORMED BY ACCRETION).
194 SW 2d 193-197 (Ark 1946).

Descriptors: *Arkansas, *Accretion (Legal aspects), *Land tenure, *Boundaries (Property), Islands, Taxes, Mississippi River, Legislation, River flow, Withdrawal, Surveys, Charts, Locating, Terrain analysis, Riparian land, Land forming, Judicial decisions, Water levels, Remedies.
Identifiers: *Adverse possession, Laches.

Plaintiff brought suit to quiet title to an island in the Mississippi River, alleging payment of taxes on said land for fifteen years under color of title. Defendants asserted that the area described in the complaint was formed from accretions to their island. They argued that, because they had paid taxes on the original land, they had necessarily paid taxes on the accretions and therefore, were entitled to be declared owners of the accretions. The court pointed out that title to land carries with it all accretions formed thereto, whether or not mentioned in the formal instrument of conveyance. The court declared that in order for land to constitute an island in a river, such land must be permanently surrounded by a river channel at all river water levels. The court was of the opinion that the evidence established that the area in controversy represented accretions to defendants' island, and that the testimony showed that plaintiff's land had been washed away and never reappeared. Furthermore, the court rejected plaintiff's claim of adverse possession because the land described in the assessment books on which plaintiff paid taxes was the land which had disappeared not the land formed by accretion. (Reed-Fla)
W69-07592

MARTIN V STANDARD OIL CO OF NEW JERSEY (ESTABLISHMENT OF RIPARIAN BOUNDARIES).

198 F 2d 523-528 (D C Cir 1952).

Descriptors: *District of Columbia, *Riparian rights, *Boundaries (Property), Rivers, Piers, Docks, Bulkhead line, Navigable waters, Permits, Rivers and Harbors Act, Federal government, Riparian waters, Legal aspects, Remedies, Judicial decisions.
Identifiers: Wharfing rights, Injunctions (Prohibitory).

In a controversy over the location of wharfing rights plaintiff requested an injunction requiring defendants to remove a pier and piles, alleging that such encroached on her riparian area. The dispute arose because the dry-land boundaries between the respective riparian lots did not run at right angles to the river. Plaintiff claimed that the riparian boundaries were projections of their lot lines. The district court found that the pier and piles did not encroach upon plaintiff's riparian area and dismissed the complaint. It found that riparian boundaries were projections of lot lines to the bulkhead line and from there ran at right angles to the bulkhead line. Both parties appealed. The court affirmed dismissal of the complaint, holding that an encroachment could not be shown since the riparian boundaries had not yet been fixed. The court stated that these boundaries should be fixed so as to balance the conflicting interests of neighboring riparian owners and of the public, with due regard for existing structures. Since the setting off of such boundaries is work for special officials familiar with the demands of navigation and wharfing, the district court was unqualified to attempt to establish such boundaries. (Gabrielson-Fla)
W69-07593

WATER RESOURCES COMMISSION.
For primary bibliographic entry see Field 04A.
W69-07594

WATER RESOURCES COMMISSION.
For primary bibliographic entry see Field 04A.
W69-07595

WATER RESOURCES COMMISSION.
For primary bibliographic entry see Field 04A.
W69-07596

WATER RESOURCES COMMISSION.
For primary bibliographic entry see Field 04A.
W69-07597

WATER RESOURCES COMMISSION.
For primary bibliographic entry see Field 04A.
W69-07598

DISPOSAL OF SEWAGE.
For primary bibliographic entry see Field 05G.
W69-07599

WATER AND ICE SUPPLIES.
For primary bibliographic entry see Field 05G.
W69-07600

THAMES RIVER VALLEY FLOOD CONTROL COMM'N.
For primary bibliographic entry see Field 04A.
W69-07601

NORTHEASTERN WATER AND LAND RESOURCES COMPACT.
For primary bibliographic entry see Field 04A.
W69-07602

APPROPRIATION OF WATERS; RESERVOIRS AND DAMS.
For primary bibliographic entry see Field 04A.
W69-07603

WELLS.
For primary bibliographic entry see Field 04B.
W69-07604

WATER SKIING

Md Ann Code art 14B sec 11 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Water skiing, *Boats, *Boating regulations, Regulation, Legislation, Recreation, Safety, Water sports.

No person under 12 years of age may operate a motorboat for the purpose of towing another on water skis or similar device. Another person at least 12 years of age must be in the vessel to observe the skier. No towing is permitted between sunset and sunrise. This statute is inapplicable to professional exhibitions or authorized regattas. (Kahle-Fla)
W69-07605

CHIEF OF DIVISION OF WATER RESOURCES AND WATER RESOURCES BOARD.
For primary bibliographic entry see Field 05G.
W69-07606

POLLUTION ABATEMENT AND CONTROL.
For primary bibliographic entry see Field 05G.
W69-07607

STATE DEPARTMENT OF HEALTH.
For primary bibliographic entry see Field 05G.
W69-07608

SOIL CONSERVATION DISTRICTS TO PREVENT EROSION.
For primary bibliographic entry see Field 04D.
W69-07609

CRIMES (BOATING REGULATIONS).
Conn Gen Stat Ann secs 53-189 thru 53-194, 53-214 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Boating regulations, *Pollution abatement, *Withdrawal, Water pollution, Contamination (Water), Water levels, Potable water, Public health, Water quality, Safety, Recreation, Boats, Legislation, Canoes, Lakes, Legal aspects.
Identifiers: *Penalties (Criminal), *Enforcement, *Motor boats.

Operation of a motor boat so as to endanger the life of persons not occupants of the boat shall be an offense punishable by fine and, or, imprisonment. Operation of a motor boat exceeding the specified engine sizes, or speeds, upon certain waterways within the state shall be punishable by fine. Operation of a boat or canoe on specified waters from one-half hour after sunset until one-half hour before sunrise without a white signal light shall be illegal and punishable by fine. Any person who causes water to be drawn off Bantam Lake by lowering the outlet shall be fined and, or, imprisoned. Pollution of any receptacle for drinking water by any foul substance shall be punished by fine and, or, imprisonment. (Harris-Fla)
W69-07610

MUNICIPAL PLANNING COMMISSION; SUBDIVISION OF LAND.

Conn Gen Stat Ann sec 8-25 (1958).

Descriptors: *Connecticut, *City planning, *Land development, *Administrative agencies, Land use, Drainage, Sewage systems, Water supply, Flood control, Flood forecasting, Water management (Applied), Recreation, Permits, Legislation, Roads, Public health, Public utilities, Legal aspects.
Identifiers: *Land subdivision, Penalties.

Subdivision of land must be approved by the Municipal Planning Commission. Any subdivision without approval shall be a finable offense. Subdivision plans must be filed, when approved, within 90 days or be null and void. Regulations for land subdivision shall be adopted by the commission after notice and hearing. Regulations shall provide for public health, water, drainage and sewerage. In areas adjacent to bodies of water subject to flooding, provision shall be made for flood control. Provisions must also be provided for public utilities, recreational needs and streets. (Harris-Fla)
W69-07612

SYSTEM OF COUNTY DRAINAGE.
For primary bibliographic entry see Field 04A.

W69-07616

FLOATING SAWDUST INTO STREAMS.
For primary bibliographic entry see Field 05G.
W69-07617

CONDEMNATION BY COUNTIES FOR WATERSHEDS.
For primary bibliographic entry see Field 04D.
W69-07618

WATER CONSERVATION AND IRRIGATION AGENCIES.
For primary bibliographic entry see Field 03F.
W69-07620

UNITED STATES V TWIN CITY POWER CO (VALUE OF WATER-FLOW AS PART OF CONDEMNATION COSTS).
For primary bibliographic entry see Field 04A.
W69-07623

WATER CONTRACTS.

Mich Comp Laws Ann secs 41.871-41.878 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Local governments, *Supply contracts, *Water supply, Domestic water, Financing, Taxes, Loans, Interest, Cities, Payment, Legislation, Facilities.
Identifiers: *Township boards, *Fire control, *Elector referendums.

Township boards of any townships of 5,000 or more population are authorized to contract with other municipalities for water for fire protection and domestic use. Township boards may borrow funds to install facilities required by such contracts. Persons, firms, and corporations are authorized to loan funds for these purposes. Township boards may pledge sales tax revenues to secure payment of borrowed funds. Townships may enact ordinances to effectuate the purpose of this act and such ordinances shall become effective thirty days from publication unless a petition for a referendum intervenes. (Harris-Fla)
W69-07626

HURON-CLINTON METROPOLITAN AUTHORITY.

Mich Comp Laws Ann secs 119.51, 119.52, 119.53, 119.57-119.61 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Local governments, *Parks, *Financing, Recreation facilities, Taxes, Boating, Fishing, Swimming, Legislation, Conservation, Assessments, Administrative agencies, Condemnation, Operation and maintenance, Real property, Land tenure, Eminent domain.
Identifiers: *Counties, *Elector approval, Enabling legislation.

The counties of Wayne, Washtenaw, Livingston, Oakland, and Macomb may form the Huron-Clinton metropolitan authority. The authority may promote, construct, own, and operate within or without its limits recreational parks with facilities for bathing, boating and fishing and other recreation. The authority may fix and collect charges for the use of facilities and may sell or purchase land, rights, or obligations subject to the approval of the electorate. The authority shall be governed by a board of commissioners and may levy a tax based on property value assessment or issue self-liquidating bonds, and disburse the revenues obtained. The authority may acquire property by purchase, gift, devise or condemnation. A referendum shall be submitted to the electors of the counties for approval of the act to incorporate the authority. Any of the counties shall constitute the authority if they approve the act by vote. (Harris-Fla)
W69-07627

MUNICIPALITIES - PARTICULAR POWERS.

Mich Comp Laws Ann secs 124.251-124.294 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Cities, *Water supply, *Sewage disposal, Contract, Financing, Condemnation, Sewers, Storm drains, Taxes, Engineering, Income, Interest, Cost analysis, Local governments, Legislation, Water distribution (Applied), Sanitary engineering.
Identifiers: *Trust indentures.

Any two or more municipalities may incorporate an authority to acquire and operate plants used or useful in obtaining, treating, and distributing water. Articles of incorporation shall set forth powers to fulfill the corporate purpose. The authority may acquire and transfer property within or without its corporate limits, including by condemnation. The authority may enter into contracts of up to 50 years duration in order to sell or purchase water and may supply water to corporate or private consumers. Municipalities may also incorporate authorities to acquire and operate storm and sanitary sewers and sewage treatment plants used or useful in collecting and disposing of sewage or industrial wastes. Incorporation shall be as provided in this act. Contracts for sewage service shall not exceed 40 years and charges by either authority may be classified or varied from time to time. No change of jurisdiction over any territory by any municipality shall impair the contract obligation for either water or sewage services. The programs and contracts outlined shall be financed according to this act. (Harris-Fla)
W69-07628

REMOVAL OF SAND AND GRAVEL.

Conn Gen Stat Ann secs 25-10 through 25-18 (1958), as amended, (Supp 1968).

Descriptors: *Connecticut, *Sands, *Gravels, *Excavation, *Tidal waters, Legislation, State governments, Channel improvement, Damages, Adjudication procedure, Channels, Permits, Navigation, Administrative regulation.
Identifiers: Penalties.

The Water Resources Commission is authorized to regulate the removal of sand and gravel from lands under tidal and coastal waters. A permit must be obtained for such removals. Procedures for hearings on permit applications are set out. The Commission is empowered to designate and lay out channels across state lands under tidal waters for the improvement of navigation. Procedures for the taking of sand or gravel from such channels are provided. Bond must be posted by the person taking the material if it is likely that someone will be damaged by the removal. The superior court for Hartford County shall appoint a committee to determine the actual amount of damage which must be paid within 60 days of the judgment. Appeals from any commission order may be made to the superior court for Hartford County. Unauthorized removal of sand or gravel is punishable by a fine of $100 and/or imprisonment of not more than 30 days. (Kahle-Fla)
W69-07633

CITY OF COLUMBIA V LENTZ (OVERFLOW OF MUNICIPAL SEWAGE SYSTEM).
For primary bibliographic entry see Field 05C.
W69-07635

COMMON JURISDICTION OF COUNTIES.

Mich Comp Laws Ann secs 45.10, 45.12, 45.14 (1967), as amended, (Supp 1968).

Descriptors: *Michigan, *Great Lakes, *Jurisdiction, *Lake shores, Lake Michigan, Lake Huron, Lake Superior, Boundaries (Surfaces), Local governments, Legislation, Legal aspects.
Identifiers: *Counties, *Concurrent jurisdiction, *Enforcement, *State boundaries, Offenses (Criminal), Penalties (Criminal).

Counties now in existence or to be later organize which border upon the shores of Lake Michigan c Lake Huron shall have jurisdiction of all offens committed on that part of the lake which is withi the state. Offenses shall be tried in either of the tw counties nearest the site of the offense. Chippew county and later organized counties which bord upon the shore of Lake Superior shall have com mon jurisdiction over offenses on parts of the lak within the state. Trial shall be had in the first cou ty to issue process against the offender. (Harri Fla)
W69-07636

FENCES-FENCE VIEWERS.

Mich Comp Laws Ann secs 43.9, 43.10 (1967), amended, (Supp 1968).

Descriptors: *Michigan, *Boundaries (Property *Boundary disputes, *Land tenure, Ponds, River Ownership of beds, Legislation, Real propert Natural streams, Barriers, Adjudication procedur Identifiers: *Fences, *Fence viewers, *Priva rights, *Arbitration.

When adjacent tracts of land require fencing, ar such tracts are bounded or separated by any rive brook, pond or creek, a fence viewer must decid whether the water itself is a sufficient fence. If h determines that the watercourse is an insufficie fence, that it is impractical to construct a fence o the true boundary, and that the owners cann agree on whose side a fence will be contructed, th fence viewers, on application made by and wi notice given to the parties involved, shall determi the method of fencing and reduce such determin tion to writing. If either party fails to maintain fence as directed, the other party may do so at th defaulting party's expense. (Harris-Fla)
W69-07637

OBSTRUCTION OF WATERS BY NEW YOR CITY, NAVIGATION OF AMBROSE CHANNE AND THE INTERFERENCE WITH NAVIG. TION IN NEW YORK HARBOR CHANNELS.

33 USCA secs 452, 453, 454 (1957).

Descriptors: *New York, *Navigation, *Feder government, *Legislation, Shellfish, Ships, Cha nels, Federal jurisdiction, Navigable wate Federal-state water rights conflicts, Wat resources development, Navigable rivers, Fishin Dredging, Harbors, Ships, Cities, Rivers.
Identifiers: Ambrose Channel, Corps of Engineer

It is unlawful for any person or persons to engage fishing or dredging for shellfish in any of the cha nels leading to and from the harbor of New Yor or to interfere in any way with the safe navigati of those channels by ocean steamships and ships deep draft. The Secretary of the Army is authoriz to make such rules and regulations for the navig tion of Ambrose Channel as he may deem necess ry to insure its safe use in all kinds of weather. T city of New York may obstruct navigation of a river or other waterway which does not form a co necting link between other navigable waters of t United States, and which lies wholly within t limits of the city. Such obstruction shall be unla ful unless the location and plans for the propos work shall have been filed with and approved the Secretary of the Army and Chief of Enginee The city of New York shall be liable for a damage that may be inflicted upon private prope by reason of any of the provisions of this sectio (Smith-Fla)
W69-07639

RIVER AND HARBOR IMPROVEMENTS.

33 USCA secs 546a, 547, 549, 550 (1957), amended, (Supp 1969).

Descriptors: *Shore protection, *Harbo *Legislation, Bank erosion, Deterioration, Erosi

ontrol, Floods, Tides, Channels, Tidal effects, ccretion (Legal aspects), Navigable waters, Federal jurisdiction, Shorelines, Local governents, Water resources development.
lentifiers: *Water terminals, Corps of Engineers, horeline configuration, Interstate commerce.

very report submitted to Congress preliminary to nprovement of any river mouth or inlet shall conin information concerning the shoreline configution ten miles either side of the proposed imrovement. The report shall state the probable efct of the improvement on the shoreline by eroon and/or accretion. A report of the benefit acruing to the locality of the improvement shall be bmitted to Congress with recommendations for cal cooperation. Deterioration of previously exting improvements shall be reported, estimating e cost of repairing, or removing obstructions om, the improvements. The Chief of Engineers, U Army, shall report on the character of all water rminals and transfers in harbors and waterways nder United States maintenance or improvement, nd determine whether they are adequate for existg commerce. He shall submit reports describing ch terminals, whether public or privately owned; hether and how they connect with railroad facilies, and whether additional terminals are needed. general report shall state terminal types suitable r national use and adaptable to commercial conions, tides, floods and other physical characristics. (Harris-Fla)
/69-07640

EPOSIT OF REFUSE IN NAVIGABLE /ATERS.

or primary bibliographic entry see Field 05G.
/69-07646

ROTECTION OF NAVIGABLE WATERS - EGULATION OF TRANSPORTATION AND UMPING REFUSE IN NAVIGABLE WATERS - IERS AND CRIBS ON MISSISSIPPI AND ST ROIX RIVERS.

or primary bibliographic entry see Field 05G.
/69-07647

ROTECTION OF NAVIGABLE WATERS - EPOSIT OF REFUSE IN LAKE MICHIGAN EAR CHICAGO.

or primary bibliographic entry see Field 05G.
/69-07648

CHULTZ V WINTHER (BOUNDARY DISPUTE NDER U S PATENT).

) Wis 2d 1, 101 NW 2d 631-640 (1960).

escriptors: *Wisconsin, *Boundary disputes, *Minders, *Patents, Shores, Lakes, Boundaries (Proerty), Judicial determination, Administrative gencies, Federal government, Surveys, Judicial ecisions, Legal aspects.
entifiers: *Omitted lands, Constructive fraud.

aintiffs claimed land under a 1956 U S patent hile defendants claimed under an 1872 patent. he issue was whether an 1863 meander line or a keshore was to be treated as the boundary line of e 1872 patent. In 1953 the federal government rdered a resurvey determining that the 1863 eander line was so far from the lake shore as to reate omitted land between the original meander ne and the shore. Plaintiffs were granted the nitted land in the 1956 patent. This court followed the general rule that meander lines are not n as boundaries, but merely to define the sinuosies of the bank. The body of water and not the eander line is the boundary. The court noted an xception to the rule where the meander line is far ough away to be intended as a boundary line or here the meander line is sufficiently in error to nount to a 'constructive fraud' on the government. Here the record did not show the percentage y which the meander line understated the various lots except in the case of one lot by an area of 27%. Such error was held not sufficient to constitute constructive fraud. The government's decisions to resurvey was held to have no bearing on the case since 'constructive fraud' is a judicial determination. Judgment for defendants. (Kahle-Fla)
W69-07649

PEART V STATE (PAYMENT FOR LAND APPROPRIATED FOR HIGHWAY).

125 So 2d 673-682 (Ct App La 1961).

Descriptors: *Louisiana, *Highway relocation, *Riparian land, *Compensation, Levees, Highways, Judicial decisions, Public benefits, Navigable rivers, Legislation, Riparian rights, Damages, Condemnation, Right-of-way, Eminent domain, Easements, Condemnation value, Legal aspects.
Identifiers: Servitude.

Plaintiff brought suit to obtain payment for land appropriated to relocate a highway more than 200 feet from a new levee on the Red River. Plaintiff's land was located between the levee and the highway. The Department of Highways claimed no compensation was due. A civil code statute imposed servitudes upon lands of riparian owners on navigable rivers for the making and repairing of levees, roads and other public works. The court held that the statute had been interpreted to impose a servitude only when the public purpose was incident to the nature, navigable character, or use of the stream. Here the original highway and the relocated highway were intended only as thoroughfares for traffic between two cities. Likewise, a second statute providing that an owner bound to give a public road must furnish a second without compensation where the first is destroyed or impassable was inapplicable, since plaintiff was not bound to give the original road unless used incident to the navigable character of the stream. Plaintiffs were awarded compensation for the right-of-way and severance damages. (Kahle-Fla)
W69-07650

UNITED STATES V STATES OF LOUISIANA, TEXAS, MISSISSIPPI, ALABAMA AND FLORIDA (OWNERSHIP OF LANDS UNDERLYING GULF OF MEXICO).

364 U S 502, 81 S Ct 258-259 (1960).

Descriptors: *United States, *Gulf of Mexico, *Boundary disputes, *Ownership of beds, Louisiana, Texas, Mississippi, Alabama, Florida, Beds, Beds under water, Mineralogy, Boundaries (Surfaces), Coasts, Continental shelf, Judicial decisions, Legal aspects.
Identifiers: Coast line.

By the terms of a final decree in an action by the United States against Louisiana, Texas, Mississippi, Alabama, and Florida for a declaration of ownership of land, minerals and other natural resources underlying the Gulf of Mexico, the United States was entitled to land and minerals underlying the Gulf of Mexico more than three miles seaward from the coast lines of Louisiana, Mississippi and Alabama, and more than three leagues seaward from the coast lines of Texas and Florida, and extending to the edge of the continental shelf. None of the states or their assigns were entitled to any interest or use of said lands and minerals. As against the United States, the defendant states were entitled to land and minerals from their coast lines to the point where United States ownership vests as outlined above. The court defined 'coast line' as the line of ordinary low water along that portion of coast which is in direct contact with the sea and the line marking the seaward limit of inland waters. Defendant states were to promptly render to the United States all sums of money derived by such state since June 5, 1950, either by sale, leasing, licensing, exploitation or otherwise on account of any of the lands or resources lying beyond their limits of ownership. (Kahle-Fla)
W69-07651

PROTECTION OF NAVIGABLE WATERS - OBSTRUCTION OF NAVIGABLE WATERS AND THE ESTABLISHMENT OF HARBOR LINES.

33 USCA sec 403, 404, 405 (1957).

Descriptors: *Piers, *Federal government, *Legislation, *Navigable waters, Breakwaters, Bulkheads, Jetties, Harbors, Canals, Navigation, Excavation, Alteration of flow, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers.
Identifiers: Corps of Engineers, Secretary of the Army, Harbor lines.

Where he deems it necessary the Secretary of the Army is authorized to establish harbor lines, beyond which no piers, wharves, bulkheads, or other works may be extended or deposits made except under such regulations as he may prescribe. Unless authorized by Congress, the creation of any obstruction to the navigable capacity of any of the waters of the United States is prohibited. It is unlawful to build any wharf, breakwater, or other structure in any port, canal, navigable river, or other body of water outside established harbor lines, or where no harbor lines have been established, except on plans recommended by the Chief of Engineers and authorized by the Secretary of the Army. It is also unlawful to excavate or fill, or in any manner modify the course, condition or capacity of any port, roadstead, haven, harbor, canal, lake, harbor of refuge, or inclosure within the limits of any breakwater, or of the channel of any navigable water of the United States, unless the work has been authorized by the above officials. The above provisions are made specifically applicable to the Potomac and Anacostia Rivers. (Smith-Fla)
W69-07652

INJURY TO HARBOR OR RIVER IMPROVEMENTS.

33 USCA secs 408, 409 (1957).

Descriptors: *Legislation, *United States, *Federal government, *Navigable waters, Harbors, Bays, Obstruction to flow, Bridges, Dams, Streams, Permits, Regulation, Transportation, Coastal structures, Seawalls, Check structures, Jetties, Retaining walls, Navigable rivers, Channels, Docks, Piers, Engineering structures, Legal aspects.

It is unlawful for any person to use or take possession of any coastal structure erected by the United States to improve or preserve navigable waters or to prevent floods. It is unlawful to obstruct navigable channels by improper anchorage or by voluntarily sinking or causing to sink a craft within such a channel. It is unlawful, except as otherwise provided, to float loose timber and logs in a navigable channel or to float sack rafts therein. The owner of a craft sunken in a navigable channel must immediately mark such craft with a buoy and light. Such owner shall immediately take action to remove the craft. Failure to act will be taken to indicate that the vessel has been abandoned and the United States will then remove the craft. (Katz-Fla)
W69-07653

PROTECTION OF NAVIGABLE WATERS - SUMMARY REMOVAL OF WATER CRAFT OBSTRUCTING NAVIGATION.
33 USCA sec 415 (1957).

Descriptors: *Navigation, *Federal government, *Legislation, *Navigable waters, Bays, Canals, Locks, Rivers, Lakes, Federal jurisdiction, Federal-state water rights conflicts, Water resources development, Navigable rivers, Boats, Eminent domain.
Identifiers: Sunken watercraft, Obstruction to navigation, Secretary of the Army.

In an emergency, any vessel, raft, or similar obstruction which is sinking or grounding, or being unnecessarily delayed in any Government canal or lock, or in any navigable waters, in such a manner as to stop, seriously interfere with, or endanger navigation, in the opinion of the Secretary of the Army or any agent to whom he may delegate proper authority, the Secretary or such agent shall have the right to take immediate possession of such boat or raft and remove or destroy it so as to clear the waters of the obstruction. The agent charged with the removal or destruction of an obstruction may in his discretion give notice in writing to the owners of any such obstruction requiring them to remove it. The expense of removing the obstruction shall be a charge against such craft and cargo, and if the owners fail or refuse to reimburse the United States for such expense within thirty days after notification, the agent may sell the craft or cargo, or any part thereof that may not have been destroyed, and the proceeds of such sale shall become the property of the United States government. (Smith-Fla)
W69-07654

OIL POLLUTION OF COASTAL WATERS - PROHIBITION AGAINST DISCHARGE OF OIL IN UNITED STATES WATERS.
For primary bibliographic entry see Field 05G.
W69-07656

THE DEPOSIT OF REFUSE IN N Y HARBOR AND ADJACENT WATERS IS PROHIBITED.
For primary bibliographic entry see Field 05G.
W69-07657

WATER POLLUTION CONTROL - CONGRESSIONAL DECLARATION OF POLICY.
For primary bibliographic entry see Field 05G.
W69-07658

WATER POLLUTION CONTROL - GRANTS FOR WATER POLLUTION CONTROL PROGRAMS - WATER POLLUTION CONTROL ADVISORY BOARD.
For primary bibliographic entry see Field 05G.
W69-07659

NAVIGATION AND NAVIGABLE WATERS.
For primary bibliographic entry see Field 05G.
W69-07660

RIVER AND HARBOR IMPROVEMENTS.
For primary bibliographic entry see Field 04A.
W69-07661

RIVER AND HARBOR IMPROVEMENTS - RIGHTS OF WAY, PRIVATE IMPROVEMENT, INTERSTATE COMPACTS AND THE POTOMAC DRAINAGE BASIN.
For primary bibliographic entry see Field 04A.
W69-07662

ACQUISITION OF LAND AND MATERIALS, REGULATION OF RESERVOIRS ON MISSISSIPPI.
For primary bibliographic entry see Field 04A.
W69-07663

COWAN V BAKER (LANDFILLS).
For primary bibliographic entry see Field 04A.
W69-07664

DITCHES, MARSHES, MEADOWS AND SWAMPS.
For primary bibliographic entry see Field 04A.
W69-07666

AUTHORITY AND DUTIES OF COMM'RS PERTAINING TO DITCHES, MARSHES, MEADOWS AND SWAMPS.
For primary bibliographic entry see Field 04A.
W69-07667

RIGHTS OF WETLAND PROPRIETORS.
For primary bibliographic entry see Field 04A.
W69-07668

APPEALS FROM ACTION OF THE COMMISSIONERS CONCERNING DRAINAGE OF WETLANDS.
For primary bibliographic entry see Field 04A.
W69-07669

JURISDICTION OF FENCE-VIEWERS.
For primary bibliographic entry see Field 04A.
W69-07670

COMPREHENSIVE HARBOR IMPROVEMENT ACT.
For primary bibliographic entry see Field 04A.
W69-07671

COMPREHENSIVE HARBOR IMPROVEMENT ACT.
For primary bibliographic entry see Field 04A.
W69-07672

COMPREHENSIVE HARBOR IMPROVEMENT ACT.
For primary bibliographic entry see Field 04A.
W69-07673

DAUGHERTY V CITY OF LEXINGTON (REASONABLE USE OF LAND).
For primary bibliographic entry see Field 05G.
W69-07674

ANDERSON V STATE (NON-RESIDENTS NOT ENTITLED TO COMMERCIAL FISHING LICENSE).

213 SW 2d 615-617 (Ark 1948).

Descriptors: *Arkansas, *Commercial fishing, *State jurisdiction, Beds, Fishing, Fish management, Judicial decisions, Legislation, Water resources, Water users, Wildlife management, Permits, Regulation, Ownership of beds.
Identifiers: Constitutional rights.

Defendants, non-residents of Arkansas, were arrested for illegally engaging in commercial fishing contrary to state law which prohibited the issuance of a commercial fishing license to any person who had not resided in the state at least 6 months. Defendants had obtained non-resident fishing licenses. The court held that the statute did not violate due process or discriminate against non-residents, since the state owns the beds of all waters within its jurisdiction and may appropriate their use to its citizens for the taking of fish. Such a right is a property right and not a mere privilege or immunity of citizenship that must be extended to non-residents nor is it a regulation of commerce. (Kahle-Fla)
W69-07675

SOIL CONSERVATION.
For primary bibliographic entry see Field 04D.
W69-07676

SCHATZ V GUTHRIE (RIGHT TO NAVIGATE A TRIBUTARY).
For primary bibliographic entry see Field 04A.
W69-07677

DOIRON V O'BRYAN (MEANING OF RIPARIAN RIGHTS IN A CONVEYANCE).
For primary bibliographic entry see Field 04A.
W69-07678

WATERS AND WATER SUPPLY.
For primary bibliographic entry see Field 03B.
W69-07679

NEW JERSEY WATER RESEARCH AND DEVELOPMENT COMM'N.

N J Stat Ann secs 58:23-1, 58:23-4, 58:23-8 (1966).

Descriptors: *New Jersey, *Water policy, *Planning, *Water resources development, Water management (Applied), Legislation, Federal government, State governments, Conservation, Research and development, Water resources, Water utilization, Administrative agencies, Water supply, Water storage, Investigations, Water sources.

The New Jersey Water Research and Development Commission is created. It consists of 9 members, 3 appointed from the Senate by the president thereof, 3 from the General Assembly by the speaker, and 3 by the governor from the citizenry. The terms of office shall be 3 years, provided, however, that a member of the legislature may serve only so long as he remains in the legislature. The commission shall keep informed of the progress of the Water Policy and Supply Council with respect to water supply sources, development and storage of resources, and long-term planning. The commission may exchange information with any state, agency, or the federal government in regard to conservation and development of water supply resources. The commission may employ clerical assistants, incur traveling expenses, obtain views of expert advisors, hold hearings and make investigations. The commission shall report annually to the governor and legislature setting forth results of investigations and recommendations. The Water Advisory Committee consists of 15 members from the state at large appointed by resolution of the commission representing the northern, central, and southern areas of the state. Terms of office shall be 3 years. The committee shall meet at the call of the commission to assist and advise the commission in its duties. (Kahle-Fla)
W69-07680

USE AND DISPOSITION OF WATER.
For primary bibliographic entry see Field 04A.
W69-07681

AN ACT FOR THE ESTABLISHMENT OF AN INTERIM COMM'N ON THE UPPER MISSISSIPPI RESERVOIRS.
For primary bibliographic entry see Field 04A.
W69-07682

SUSQUEHANNA RIVER BASIN COMM'N, ARTS 6, 7 and 8 (FLOOD PROTECTION, WATERSHED MANAGEMENT AND RECREATION).
For primary bibliographic entry see Field 04A.
W69-07683

SUSQUEHANNA RIVER BASIN COMM'N, ARTS 9, 10, 11 and 12 (PUBLIC VALUES, HYDROELECTRIC POWER, DIVERSIONS AND INTERGOVERNMENTAL RELATIONS).
For primary bibliographic entry see Field 04A.
W69-07684

SUSQUEHANNA RIVER BASIN COMM'N, ART 14 (PLAN, PROGRAM AND BUDGETS).
For primary bibliographic entry see Field 04A.
W69-07685

CONTRACTS FOR INTERSTATE BRIDGES; REPORT TO GOVERNOR; DIVERSION OF NONNAVIGABLE STREAM.
For primary bibliographic entry see Field 04A.
W69-07686

FERRIES.
W Va Code Ann secs 17-18-2 through 17-18-8, 17-18-11, 17-18-16 through 17-18-18 (1966).

Descriptors: *West Virginia, *Navigable waters, *Permits, *Boats, Transportation, Boundaries (Property), Legislation, Watercourses, Navigation, Transfer, Local governments, Riparian rights, Regulation, Navigable rivers, Riparian waters, Administrative agencies, Maintenance costs, Initial costs, Interstate rivers, Legal aspects.
Identifiers: *Ferries, Shenandoah River, County courts.

A person desiring to establish a ferry may present his application to the county court. If the watercourse represents a county boundary line, he may apply initially to either county court. The court shall then appoint at least two viewers to render an advisory report on the advantages of the ferry. The court may then reject or grant the application. If more than one county is involved and the first court agrees to grant the application, it shall then certify its report to the second county court which must decide whether to grant or reject. Any person who maintains an unauthorized ferry and any riparian owner who permits the unauthorized ferry to be maintained on his land shall be guilty of a misdemeanor. A ferry must provide any person or property with passage in a reasonable time. The county court of any county through which the Shenandoah River runs may establish and maintain not more than three ferries across the river. The expenses shall be paid out of the county treasury. No ferry in an adjacent state shall ferry to the shores of this state without the consent of the proprietor of any ferry established in this state which is operating within two miles of such ferry. (Stewart-Fla)
W69-07687

WATERSHED IMPROVEMENT DISTRICTS.
For primary bibliographic entry see Field 04D.
W69-07688

TRUSTEES OF INTERNAL IMPROVEMENT FUND V WETSTONE (ESTABLISHMENT OF BOUNDARY LINE).

222 So 2d 10-19 (Fla 1969).

Descriptors: *Florida, *Boundary disputes, *Boundaries (Property), High water mark, Islands, Patents, Federal government, State governments, Navigable waters, Mangrove swamps, Tides, Tidal waters, Tidal effects, Water levels, Ownership of beds, Shores, Land classification, Judicial decisions, Legal aspects, Riparian land, Water law, Meanders.
Identifiers: Meander lines, High tide line.

Plaintiff sought a declaratory decree establishing a boundary line between privately owned riparian uplands and submerged sovereignty lands under navigable waters. Plaintiff landowner contended the meander line established in 1875 represented the proper boundary. The defendant trustees contended that the true mean high tide line controlled. The circuit court rendered judgment for the plaintiff and the district court affirmed. On appeal on conflict certiorari the Florida Supreme Court affirmed and held that where the true mean high tide line circumscribing plaintiff's insular property could not be located due to the fact that its outer edges were covered with mangrove swamp areas, but the meander line established by the original government survey could be located, and where acreage conveyed by defendants to plaintiff's predecessor in title was based on acreage referred to in the original government survey, the meander line constituted the boundary line between the swamplands and sovereignty lands. (Carruthers-Fla)
W69-07689

GAME AND FRESHWATER FISH.
For primary bibliographic entry see Field 08I.
W69-07690

INTERSTATE COMM'N ON THE POTOMAC RIVER BASIN.
For primary bibliographic entry see Field 05G.
W69-07691

ABATEMENT OF NUISANCES.
For primary bibliographic entry see Field 05G.
W69-07692

ACCRETION AND IMPROVEMENTS TO LAND ON NAVIGABLE WATER.
For primary bibliographic entry see Field 04A.
W69-07693

LEASING OF OYSTER BEDS.
For primary bibliographic entry see Field 03E.
W69-07694

HEALTH AND SAFETY.
For primary bibliographic entry see Field 05G.
W69-07695

CESSPOOLS, PRIVY WELLS AND DRAINAGE SYSTEMS.
For primary bibliographic entry see Field 05G.
W69-07696

POLLUTION OF STREAMS.
For primary bibliographic entry see Field 05G.
W69-07697

FISH.
For primary bibliographic entry see Field 03E.
W69-07698

PRIVATE PRESERVES.
For primary bibliographic entry see Field 03E.
W69-07699

6G. Ecologic Impact of Water Development

POND ECOLOGY AND WATERFOWL PRODUCTION IN RELATION TO OPTIMUM WATER RESOURCES UTILIZATION IN THE TURTLE MOUNTAINS OF NORTH DAKOTA,
North Dakota State Univ., Fargo. Dept. of Zoology.
J. Frank Cassel, and Robert E. Stewart, Jr.
Research Project Technical Completion Report to Office of Water Resources Research, Department of the Interior, April 1969. 50 p, 14 fig, 11 tab, 20 ref.

Descriptors: *Animal populations, *Ducks (Wild), *Ecology, *Water chemistry, *Wetlands, American Widgeon, Blue-Winged Teal, Broods Bufflehead Duck, Canvasback Duck, Common Goldeneyed Duck, Gadwall Duck, Green-Winged Teal, Lesser Scaup Duch, Mallard Duck, migratory birds, Pintail Ducks, Puddle Ducks, Redhead Duck, Ring-Neck Duck, Ruddy Duck, Shoveler Duck.

During drought years of 1967 and 1968, 60 quarter sections, including 206 wetlands, were studied in the Turtle Mountains of North Dakota. Waterfowl surveys were made, and wetlands were classified and sampled for water chemistry. Due to drought conditions, acreages of wetlands decreased progressively. Some wetlands were more abundant during the two years; cover types varied. Water chemistry determinations indicated a graphical relationship between wetland subclasses and specific conductance. Fifteen species of waterfowl were found in the area the most common of which were mallard, blue-winged teal, ring-necked duck, lesser scaup, redhead, and canvasback. Total waterfowl population estimates varied from 3768 plus or minus 1937 in 1967 to 3179 plus or minus 966 in 1968. Significant conclusions concerning dabbling ducks and diving ducks include: A decrease in spring densities was noted for most species from 1967 to 1968. Most species, except blue-winged teal, produced fewer broods in 1968 than in 1967. Average brood size for the most common species decreased in 1968. Dabbling ducks gathered in small mobile flocks during June, 1968. Diving ducks formed large mobile flocks during early and late June, 1968. Most ducks gave no indication of breeding activity other than maintenance of some pair bonds. Hatch peaks tended to be later in 1968. A large influx of dabbling ducks into the Turtle Mountains was recorded in June of 1968.
W69-07475

THE ORGANIZATION AND ANALYTICAL PROCEDURES REQUIRED BY A LARGE ECOLOGICAL SYSTEMS STUDY,
California Univ., Berkeley. Dept. of Entomology and Parasitology.
Ronald W. Stark.
Systems Analysis in Ecology, K E F Watt (ed), Academic Press, New York, pp 37-68, 1966. 7 fig, 3 tab, 49 ref.

Descriptors: *Ecosystems, *Systems analysis, *Analytical techniques, *Planning, Insect control, Pine trees, Sampling, Aerial photography, Computers, Research and development.
Identifiers: *Computer analysis, Beetles, Dendroctonus brevicomis.

A description is given of the organization and analytical procedures developed in studying the ecology of western pine beetles, Dendroctonus brevicomis. The objective was to learn how to predict the course of population buildups in order to control their destruction of ponderosa pine forests. 26 scientists from 10 academic, government, and industry departments were involved. A study of the geographic distribution of the beetle and its hosts was made, including seasonal variations. Up to the time of this report work has dealt with the elaboration of sampling procedures for the study of complex systems, in this case involving geography, season, infested trees, and insects within the trees, all with computer analysis capability in mind. Aerial photography for the analysis of populations of infested trees and X-ray techniques for analysis of insects within trees are found to be more efficient and economical than visual observation and bark dissection procedures. (Watts-Wisconsin)
W69-07576

07. RESOURCES DATA

7A. Network Design

HYDROLOGICAL FORECASTING IN THE USSR,
Hydrometeorological Service of the USSR (Moscow). Scientific Research Center.
For primary bibliographic entry see Field 02B.
W69-07379

RAINGAGE NETWORKS IN THE LARGEST CITIES,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
For primary bibliographic entry see Field 02B.
W69-07485

COMPUTER SOLUTIONS TO DISTRIBUTION NETWORK PROBLEMS,
Boeing Co., Renton, Wash.
Samuel L. W. Jacoby, and David W. Twigg.

Proc, Nat Symp Anal Water-Resource Syst, pp 167-190, Denver, July 1-3, 1968. 28 p, 3 fig, 11 ref.

Descriptors: *Network design, *Simulation analysis, *Optimization, *Digital computers, Distribution systems, Mathematical models, Cost analysis, Water supply, Analytical techniques, Data processing.
Identifiers: Method of feasible directions, Gradient method.

Systematic methods of solving distribution network design problems using simulation and optimization techniques were presented. Non-linear models were constructed. Simulation, gradient, and 'methods of feasible directions' techniques were used. Data processing systems were used for the evaluation of network designs and for aiding parametric studies by improving the speed, accuracy and data handling characteristics of simulation problems optimizing network designs. The design of computing systems and the synthesis of the problems were discussed and plans for introducing optimization into simulation in the future were discussed. For main entry see W69-07562. (Thiuri-Cornell)
W69-07572

7B. Data Acquisition

POSSIBILITIES FOR REMOTE DETECTION OF WATER IN ARID AND SUBARID LANDS DERIVED FROM SATELLITE MEASUREMENTS IN THE ATMOSPHERIC WINDOW 3.5-4.2 mu,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
Jean Pouquet.
International Conference on Arid Lands in a Changing World, Arizona University, Tucson, June 3-13, 1969. 17 p, 9 fig, 11 ref.

Descriptors: *Remote sensing, *Arid lands, *Subsurface waters, Soil water, Soil moisture, Soil temperature, Groundwater, Exploration, Hydrography, Mapping, Water resources development, Water supply, Aerial photography, Satellite (Artificial), Infrared radiation.

The purpose of this work was to survey water resources and assess agricultural possibilities in arid and subarid lands. Detection was either of subsurface water through its direct thermal effect or the soil moisture storage capacity. Daytime infrared radiations were almost useless because the scanned areas were too large; the eastern temperatures were too high, the western too low. But, nighttime infrared values proved most useful. (Soil moisture moves toward the cooler profile, at night the cool surface. It carries stored daytime warmth with it to the surface). Most useful were grid print maps of ground equivalent black body temperatures derived from Nimbus radiometer measurements in the 3.5-4.2 mu range. Several examples from Africa and North America are presented. By locating areas appearing warmer than they should be, preselection of promising areas for field exploration was made, which from the ground could take years. It is speculated that infrared sensing will become one of the principle media used for the systematic survey of arid land resources. (Sherbrooke-Ariz)
W69-07356

A GEOMETRIC METHOD TO SUBDIVIDE THE PATAPSCO FORMATION OF SOUTHERN MARYLAND INTO INFORMAL MAPPING UNITS FOR HYDROGEOLOGIC USE,
Maryland Geological Survey, Baltimore.
Harry J. Hansen.
Geol Soc Amer Bull, Vol 80, No 2, pp 329-336, Feb 1969. 8 p, 5 fig, 23 ref.

Descriptors: *Stratigraphy, *Coastal plains, *Aquifers, *Maryland, Hydrologic data, Mapping, Geologic mapping, Cross-sections, Transmissivity, Sands.
Identifiers: Patapsco Formation (Maryland).

The Patapsco Formation of southern Maryland is a thick, heterogeneous sequence of unconsolidated rocks occurring in the upper part of the Potomac Group. Experience suggests that it functions as a multi-aquifer unit of hydraulic complexity. In the absence of definitive geologic criteria an adaptation of Haites' (1963) technique of perspective correlation is used to subdivide the Patapsco Formation into consistently defined mapping units. These units are useful for delineating vertical and horizontal changes in such parameters as sand percentage and coefficient of transmissibility. (Knapp-USGS)
W69-07387

DETERGENTS AND GROUNDWATER SUPPLY (FRENCH),
CERH Montpellier (France). Dept. of Sciences.
For primary bibliographic entry see Field 05B.
W69-07390

POTENTIAL ECONOMIC BENEFITS FROM THE USE OF RADIOISOTOPES IN FLOW MEASUREMENTS THROUGH HIGH-HEAD TURBINES AND PUMPS,
Bureau of Reclamation, Denver, Colo. Div. of Project Investigations.
For primary bibliographic entry see Field 08C.
W69-07404

PIEZOMETER DETECTION OF SATURATED INTERFLOW IN SOILS,
Tennessee Valley Authority, Knoxville.
Roger P. Betson, John B. Marius, and Robert T. Joyce.
Soil Science Society of America Proceedings, Vol 32, No 4, pp 602-604, July-August 1968. 2 p, 1 fig, 1 tab, 3 ref.

Descriptors: *Piezometers, Instrumentation, Soil water, *Saturated flow, Watershed hydrology.

Piezometers were used as saturated interflow detection devices in a study of partial watershed contribution to storm runoff. Saturated interflow was detected along the AB-horizon interface in clay loam soils with shallow A horizons. The results of the study showed that at least under some soil conditions piezometers can be useful in determining the extent of saturated flow within a watershed. The occurrence of this flow will normally be confined to the shallow A-horizon regions.
W69-07463

A TECHNIQUE TO INFER ATMOSPHERIC WATER-VAPOR MIXING RATIO FROM MEASURED HORIZON RADIANCE PROFILES,
National Aeronautics and Space Administration, Langley Station, Va. Langley Research Center.
Thomas B. McKee, Ruth I. Whitman, and Jules J. Lambiotte, Jr.
NASA Tech Note D-5252, June 1969. 33 p, 7 fig, 5 tab, 12 ref.

Descriptors: *Meteorology, *Atmospheric physics, Air masses, Atmospheric pressure, Humidity, Solar radiation, Temperature, Weather data.
Identifiers: *Horizon radiance profiles, *Atmospheric water-vapor mixing ratio.

A technique is presented to infer atmospheric water-vapor mixing-ratio structure from measured horizon radiance profiles when a method exists for calculating radiance profiles. Inferred mixing-ratio accuracy for the 10-km to 35-km altitude range is shown when the computer program input data contain no errors and when the computer program input is perturbed by errors normally found in measurements. Water-vapor mixing ratios are inferred from horizon radiance profiles measured in the summer in an altitude range from 17 deg to 58 deg from NASA Project scanner flight. No significant altitudinal variation existed above an altitude of 18 km. Below 18 km an altitudinal variation does exist that is consistent with the large variations that are known to exist in the troposphere. The mixing ratio decreases with altitude to a minimum at a point ranging from 3 km to 5 km above the tropopause altitude. Above an altitude of 20 km the mixing ratio shows a slight increase to 35 km. (Knapp-USGS)
W69-07491

A NEW METHOD OF INVESTIGATING RIVER RECESSION CURVES,
Usk River Authority, Newport (England).
T. R. E. Chidley.
J Inst Water Eng, Vol 23, No 3, pp 177-186, May 1969. 10 p, 8 fig, 8 tab, 3 ref.

Descriptors: *Recession curves, *Base flow, *Streamflow forecasting, Hydrographs, Water levels, Groundwater movement, Runoff, Surface-groundwater relationships.
Identifiers: Stream recession, River USK (U.K.).

A statistical method of analyzing and forecasting river recession curves within 3 days after the cessation of rain is presented. The principle underlying the method is to isolate the rate of recession and to relate this by regression analysis to parameters which physically are known to affect the rate of recession. River discharge (implicitly a measure of groundwater levels), antecedent conditions, and season were used. Other more objective parameters could be used. The basis for the method is completely munerical, and any recession curve can be analyzed automatically from a set of rainfall and runoff data by either a computer or a trained clerk. All subjectivity has been removed from the analysis except in the choice of parameters believed to affect rate of recession. (Knapp-USGS)
W69-07493

NEW CONCEPTS IN THE DOMAIN OF RECORDING GAGES IN 1968: DEVICES PRESENTLY UTILIZABLE, PROTOTYPES AND DESIGNS (FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France).
P. Dubreuil.
Cah ORSTOM, Ser Hydrol, Vol 5, No 4, pp 3-23, 1968. 21 p, 3 fig, 3 tab, 12 ref.

Descriptors: *Hydrometry, *Instrumentation, *Gages, *Design, *Design criteria, *Design data, High water mark, Hydrometers, Gaging stations, Distribution, Industrial production, Low water mark, Discharge measurement, Water supply, Automatic control, Automation, Pressure measuring instruments.
Identifiers: *France, Recording gage.

The status of hydrologic recording gages in France, their principal characteristics and their use under various hydrogeological conditions are investigated on the basis of field and laboratory data given in earlier publications. The study shows there are 1,220 hydrologic gaging stations in France, with 450 stations located in the rural areas. In general over 50% of the recording stations are equipped with relatively modern devices not older than 10 years. (Gabriel-USGS)
W69-07536

7C. Evaluation, Processing and Publication

THEORETICAL ANALYSIS OF REGIONAL GROUNDWATER FLOW, 3. QUANTITATIVE INTERPRETATIONS,
For primary bibliographic entry see Field 02F.
W69-07339

A SEMIAUTOMATIC METHOD FOR REDUCING STREAMFLOW RECORDS,
Utah State Univ., Logan. Dept. of Forest Science.
George E. Hart.
J Soil and Water Conserv, Vol 24, No 2, pp 63-65, Mar-Apr 1969. 3 p, 3 fig, 4 ref.

Descriptors: *Hydrograph analysis, *Data processing, *Discharge (Water), *Computer programs, Analytical techniques, Stream gages, Hydrologic data, Runoff, Rainfall-runoff relationships.
Identifiers: Semiautomatic stream-gage data reduction.

A semiautomatic digital computer system for use in small projects is designed to reduce streamflow records and interpret hydrographs. Time and water-level coordinates are transferred directly from the field record to computer cards by manual key-punching, using the analyst's judgement as to the detail required to characterize the hydrograph. About 30 man-weeks were needed to transcribe 40 water-yrs of record in a recent study. A FORTRAN IV program is available from the author to use in reducing the punched-card data. It has a variable time scale, calculates discharges, and detects input errors. (Knapp-USGS)
W69-07376

HYDROLOGIC AND CLIMATOLOGIC DATA, 1968, SALT LAKE COUNTY, UTAH,
Geological Survey, Salt Lake City, Utah.
For primary bibliographic entry see Field 02B.
W69-07407

METEOROLOGICAL AND HYDROLOGICAL DROUGHT IN RARITAN RIVER BASIN IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.
For primary bibliographic entry see Field 02B.
W69-07457

WATER RESOURCES OF NORTH CAROLINA: AN INVENTORY OF INFORMATION AND DATA,
North Carolina Univ., Chapel Hill.
Frederick E. McJunkin, Mary J. Coe, and Bruce A. Knarr.
Report No. 22, Water Resources Research Institute of The University of North Carolina 1968. 384 p, 1 tab, 4998 ref, 6 append. OWRR Project A-018-NC.

Descriptors: *Water resources, *North Carolina, Documentation, *Bibliographies, *Data collections, *Publications.

A comprehensive inventory and index to all printed information and data relevant to North Carolina's water resources. Includes author index, subject index, and geographic index all arranged alphabetically. (Howells-NC)
W69-07478

A THREE DIMENSIONAL STUDY OF PARAMETERS RELATED TO THE CURRENT DISTRIBUTION IN LAKE ROOSEVELT,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 02H.
W69-07481

AUTOMATIC CALCULATION OF MEAN MONTHLY AND ANNUAL PRECIPITATION IN WHICH SOME MEASUREMENTS ARE MISSING (FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France). Dept. of Hydrological Research.
J. Sircoulon, and J. Cruette.
Cah ORSTOM, Ser Hydrol, Vol 5, No 4. pp 43-56, 1968. 14 p, 2 fig, 5 tab, append.

Descriptors: *Mathematical studies, *Mathematical models, *Precipitation (Atmospheric), *Rain, Hydrologic data, Statistical methods, Automation, Gaging stations, Rain gages, High water mark, Low water mark, River basins, Watersheds (Basins).
Identifiers: Rain gage data.

This article discusses the application of POH-106 program for the calculation of mean annual and monthly precipitations on the basis of Thiessen's method and using the charts COH-102 of total rain gage data. This program is considerably more complete than the POH-104 program utilizing the daily precipitation values and is, in reality, a method of substitution by using rain gage observations. The application of the method, however, is conditioned by the lengths of distance intervals between the rain gage stations. (Gabriel-USGS)
W69-07538

DIGITAL SIMULATION OF CHANNEL NETWORKS,
IBM Watson Research Center, Yorktown Heights, N. Y.
For primary bibliographic entry see Field 02E.
W69-07542

ANALYSIS OF WATER-RESOURCE SYSTEMS,
American Water Resources Association, Urbana, Ill.
For primary bibliographic entry see Field 06A.
W69-07562

08. ENGINEERING WORKS

8A. Structures

LARGE RIVER DAMS (FRENCH),
Rhone National Co. (France).
Marc Henry.
Travaux, Vol 52, No 409, pp 191-197, Apr 1969. 7 p, 3 fig.

Descriptors: *Dams, *Streamflow, *Reservoirs, Floods, Solid wastes, Sediment discharge, Water circulation, Velocity, Dam sites, Embankments, Equipment, Alluvium.
Identifiers: Large river dam.

This article presents pertinent engineering and hydrological considerations for proper construction of dams across large rivers. The article contains the following brief chapters; (1) raising the water levels in the upper reaches; (2) elimination of water circulation sediments. (3) particular characteristics of river dams; (4) water-gate types; and (5) dams built on alluvium foundations. (Gabriel-USGS)
W69-07365

DESIGN OF DAMS FOR MILL TAILINGS,
Bureau of Mines, Washington, D. C.
For primary bibliographic entry see Field 05G.
W69-07473

SOME NOTES ON THE RATIONAL METHOD OF STORM DRAIN DESIGN,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
For primary bibliographic entry see Field 02A.
W69-07482

SEWERED DRAINAGE CATCHMENTS IN MAJOR CITIES,
American Society of Civil Engineers, Cambridge, Mass. Engineering Sciences Lab.
For primary bibliographic entry see Field 02A.
W69-07486

8B. Hydraulics

RUBBLE MOUND BREAKWATER BEHAVIOR UNDER WAVE ACTION (FRENCH),
Electricite de France. Dept. of Studies and Research.
Adelkis J. Rogan.
Elec De France, Bull de Dir Etud et Rech, Ser A, Suppl No 1, 1968. 153 p, 31 fig, 11 tab, 1 photo, 65 ref, 4 append.

Descriptors: *Breakwaters, *Dams, *Water (Water), Construction, Stability, Mathematical models, Model studies, Equilibrium, Deterioration, Statistical methods, Stochastic processes, Frequency, Probability, Reynolds number, Floods, Water levels, Density, Viscosity, Talus.
Identifiers: Wave action-jetty behavior.

The study is a monograph on the behavior of jetties under the wave action of regular swells and irregular wind waves. After giving a critical review of several classical and standard formulas, the author develops simple formulas based on the use of the continuity equation, Navier-Stokes equations and introducing the 'wave-action-time' parameter. These modified formulas were applied to a series of model tests using a flume and a paddle producing swells during which the height of waves (H), their period (T), and destruction time (t) of the breakwater model were recorded. Another series of experiments was conducted by using a flume with removable cover and a fan. The study shows that the destructive wave height is very closely equal to the significant height H, used in many countries as the design wave height. In general, certain strength limits can be evaluated for the structures with the aid of the 'destruction-risk criterion' defined in the model tests and statistical analysis of wave recordings at a proposed jetty site. (Gabriel-USGS)
W69-07535

DESIGN OF SEWER SYSTEMS,
Colorado State Univ., Fort Collins.
Mell Holland.
Proc, Nat Symp Anal Water-Resource Syst, pp 218-224, July 1-3, 1968. 7 p, 4 fig, 4 ref.

Descriptors: *Sewers, *Design flow, *Pipes, *Optimization, *Linear programming, Sanitary engineering, Constraints, Hydraulics, Network design.
Identifiers: *Tree network, *Looped network.

Linear programming solutions to the problem of optimal design of a sewer system were presented. The objective was to minimize the total cost of materials and placement. Linear programming techniques were used to determine the optimal layout design. Three alternative approaches to the design of sewer systems were considered. The first was the current approach based on a selected layout for which a tentative set of pipe sizes and slopes was chosen on the basis of engineering experience and judgment. This approach did not include an explicit optimization. The second approach was a two-phased approach in which the layout selection and sthe specifications for the pipe sizes and slopes were optimized in separate steps. The selection of the layout was found to be the more difficult of the two phases. The third and optimal alternative included the simultaneous optimization of the layout, the pipes and the slopes. There was no procedure available for this approach. For main entry see W69-07562. (Thiuri-Cornell)
W69-07574

8C. Hydraulic Machinery

POTENTIAL ECONOMIC BENEFITS FROM THE USE OF RADIOISOTOPES IN FLOW MEASUREMENTS THROUGH HIGH-HEAD TURBINES AND PUMPS,
Bureau of Reclamation, Denver, Colo. Div. of Project Investigations.
Edmund Barbour.
Bur Reclam Eng Monogr No 38, 1969. 25 p, 6 fig, 5 tab.

Descriptors: *Pumps, *Hydraulic turbines, *Flow measurement, *Tracers, *Radioisotopes, Pump testing, Hydraulics, Performance, Hydraulic equipment, Instrumentation, Tracking techniques, Pipe flow, Flowmeters.

Identifiers: *Conduit flow metering.

The uses of radioisotopes to measure flow of fluids through high-pressure turbines and pumps is summarized as part of a program for the development of simple, accurate, inexpensive flow-measurement systems. Other methods are briefly reviewed. Of the 11.6 million kw capacity in Bureau of Reclamation powerplants, 3 million kw are considered amenable to radioisotope flow measurements. If the method makes operation 1/2% nearer to potential efficiency, a gain of $2 million in 10 yrs is possible. Pumps are more difficult to test. Of 1.7 million hp, about 1 million may be tested by radioisotope methods, yielding as much as 1% greater efficiency at a saving of $1.3 million in 10 yrs. Good flow rate measurement will also allow improved equipment design with large savings. (Knapp-USGS)
W69-07404

8G. Materials

TRANSPORTATION OF DEMINERALIZED WATER,
San Diego Dept. of Utilities, Calif.
For primary bibliographic entry see Field 03A.
W69-07524

8I. Fisheries Engineering

GAME AND FRESHWATER FISH.

Md Ann Code art 66c secs 200 to 209, 214 to 218, 222, 224, 225, 226 (1957), as amended, (Supp 1968).

Descriptors: *Maryland, *Fishing, *Fish management, *Administrative agencies, Freshwater fish, Fish, Fish conservation, Fish hatcheries, Farm ponds, Fish stocking, Fish establishment, Fish ladders, Dams, Trout, Permits, Legislation, Legal aspects, Water law, Water policy, Jurisdiction, Ponds, Fresh water, Recreation, Tidal waters.
Identifiers: Nontidal waters, Seasons (Fishing), Shad.

The lines separating tidal and nontidal waters within the state are described. Fish ladders must be built when dams are placed across streams. Preventing fish from having free access up and down streams is unlawful. Dynamiting streams is illegal. The Game and Inland Fish Commission has jurisdiction to establish regulations concerning fishing in nontidal waters. Seasons for all fish are presently year long. All persons fishing for trout in designated trout streams must purchase a trout stamp in addition to their regular fishing license. Fishing at night in trout streams and taking shad by means other than angling are prohibited. There are a number of other general restrictions on fishing in nontidal waters. Fishing on private ponds stocked by the owner is illegal. Persons who raise game fish must purchase an annual permit. A license is necessary for operation of a pond where fishing is permitted on payment of a fee. The commission may take fish for purpose of propagating in captivity and returning the fry to public waters and may maintain suitable fish hatcheries for this purpose. There are special regulations for Deep Creek Lake and Caroll County. (Johnson-Fla)
W69-07690

10. SCIENTIFIC AND TECHNICAL INFORMATION

WATER RESOURCES OF NORTH CAROLINA: AN INVENTORY OF INFORMATION AND DATA,
North Carolina Univ., Chapel Hill.
For primary bibliographic entry see Field 07C.
W69-07478

BIBLIOGRAPHY OF HYDROLOGY OF THE UNITED STATES AND CANADA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
W69-07517

QUANTITATIVE FORMULATION OF STREAM AND WATERSHED MORPHOLOGY,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04D.
W69-07546

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A. Center of Competence:		
(1) University of Florida - Eastern U.S. Water Law	W69-07264 -- W69-07336 W69-07577 -- W69-07699	189
(2) Geological Survey - Hydrology	W69-07360 -- W69-07422 W69-07481 -- W69-07554 W69-07562	136
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(9) Oklahoma Water Resources Research Institute	W69-07474	1
(10) North Dakota Water Resources Research Institute	W69-07475	1
(11) Office of Saline Water	W69-07476 and W69-07477	2
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(13) Abt Associates, Inc. (OWRR Project C-1469)	W69-07479	1
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Title	Author	Organization	SWRA Abstract (Ref. to Vol. 2, 1969)
Effects of Urbanization on Unit Hydrographs for Small Watersheds, Houston, Texas, 1964-67 (2 vols)	W.H. Espey, Jr., D.E. Winslow	TRACOR, Inc.	No. 6, p. 2, W69-02354
Main I, A System of Computerized Models for Calculating and Evaluating Municipal Water Requirements (2 vols)		Hittman Assoc., Inc.	No. 9, p. 56, W69-03201
Main I, A System of Computerized Models for Calculating and Evaluating Municipal Water Requirements (two magnetic tapes $75 each: tape one, Library of Water Usage Parameters, tape two, Source Language Programs)		Hittman Assoc., Inc.	No. 9, p. 56, W69-03202
A Study to Determine the Cost of Water In Industrial Uses	H.C. Bramer D.J. Motz	Cyrus W. Rice & Co.	No. 9, p. 55, W69-03322
Northwood Gaging Installation, Baltimore - Instrumentation and Data	L.S. Tucker	American Society of Civil Engineers	No. 9, p. 7, W69-03507
Oakdale Gaging Installation, Chicago - Instrumentation and Data	L.S. Tucker	American Society of Civil Engineers	No. 9, p. 7, W69-03508
Response Characteristics of Urban Water Resources Data Systems	J.C. Schaake, Jr.	American Society of Civil Engineers	No. 9, p. 65, W69-03509
A Critical Review of Methods of Measuring Discharge Within A Sewer Pipe	H.G. Wenzel, Jr.	American Society of Civil Engineers	No. 9, p. 66, W69-03510
The Nature of Changes in Urban Watersheds and Their Importance in the Decades Ahead	M.B. McPherson	American Society of Civil Engineers	No. 9, p. 34, W69-03511
Estimation of Recreational Benefits at Some Selected Water Development Sites in California	Leonard Merewitz	Planmetrics, Inc.	No. 9, p. 51, W69-03578
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Urban Water Resources Research; Systematic Study and Development of Long-Range Plans, First Year Report, September 1968		American Society of Civil Engineers	No. 9, p. 50, W69-03506

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